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RURAL HOUSEHOLDS` ACCESS TO DOMESTIC WATER USE IN THE SEBETA HAWAS DISRICT, OROMIA REGION, ETHIOPIA

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Rural Households` Access to Domestic Water Use in the Sebeta Hawas District, Oromia Region, Ethiopia.

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This is to certify that the thesis prepared by Meseret Misgana, entitled "Rural households` access to domestic water use in the Sebeta Hawas District, Oromia Region, Ethiopia" Submitted partial fulfillment of the Requirements for the Degree of Masters of Art in Geography and Environmental studies, specialization: Population, Resources and Development complies with the regulation of the university and meets the accepted standards with respected to originality and quality.

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ABSTRACT

The objective of this research is examining rural households` access to domestic water use in the Sebeta Hawas district, Oromia Region, Ethiopia. The major determinants to amount of water consumption are time from source of water and price. The paper analyzes households` water use both in the rainy and dry seasons. Via stratifying random sampling and purposive sampling techniques sorted the district in to four parts based on water accessibility. From total of 1764 households 120 households were interviewed using structured and semi structured questionnaire. SPSS software has been used for data analysis. Using the logit model for water demand that the paper found to be water demand is price inelastic. The vital determinates of water use are household size, education level, occupation of household head and distance. The survey result shows that more than half of the population consumed unsafe water in the dry seasons.

Majority of rural household drinking water sources were surface water. It was contaminated by animals, birds, worm, insects and uncontrolled flooding. Maintaining and preserving of these sources is less compared to improved water source. The sampled rural households' have the amount of water consumption in liters per day per household were 99.75liters in the rainy seasons and 118 liters in the dry seasons. Household apparently has small volume of available water per capital. The average water use was 14.25 and 16.86 Liters per capita per day in the rainy and dry seasons respectively. Amount of water demand liter per day exceeds supply in the study areas.

Alternative water source of rural households` are protected and unprotected water sources. Many household uses unprotected sources. Water source required to be clearness of surrounding and protected from contamination. Households were dissatisfied with water supply services. The household satisfaction has been 34 percent in water supply service. Reliability of water supply sources was not good. Due to some water supply service was ceased.

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LIST OF ACRONOMY

AO- Agricultural office

CSA- Central Statistics Agency

FEDO- Finance and Economic Development Office

IWRA- International Water Resources Association

WWC- World water council

WHO - World Health Organization

UAP- Universal Access to Plan

UN- United Nation

ADF- African Development Fund

NAS- National Academy of Science

MDG- Millennium Development Goal

WRI - World resource institute

IWMI- international water management institute

MoWR- Ministry of Water Resources

SH- Sebeta Hawas

SHW- Sebeta Hawas Woreda

SHFEDO- Sebeta Hawas Finance and Economic Development Offices

R-WASH- Rural Water Supply and Hygiene

WBCSD- World Business Council for Sustainable Development

WMEO- Water, Mineral and Energy Office

UNICEF- United Nations Children's Fund

CHAPTER ONE

1. INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Water is fundamental for life and health. Worldwide 1.2 billion people are without access to safe water (Klawitter and Qazzaz, 2005). Consequently, water and sanitation related diseases are widespread (Patrick et al., 2004). When human beings do not have access to potable water; they not only suffer physically and emotionally but also socio-economically. Millennium Development Goal 7C calls to halve by 2015 the proportion of the population without sustainable access to safe drinking water. While the safe drinking water target was met in 2010, 783 million people still do not have access to safe drinking water, and major issues related to equity of access, water quality, and sustainability of water supplies remain (WHO, 2012).

UNICEF (2010) reported that in the world 884 million people use unimproved drinking water sources in 2010, and in 2015 estimates about 672 million people will still using unimproved drinking water sources. The WHO (2000) reported that seventy five percent of all diseases in developing countries arise from polluted drinking water. The lack of access to water also limits sanitation and hygiene practices in many households because of the priority given for drinking and cooking purposes.

Ethiopia like any other developing countries has many constraints to make potable water easily accessible. Only 38% of total population and 26% of rural population have access to safe and clean water (WHO and UNICEF, 2010). Moreover, Ethiopia is off track to meet the MDG target of access to safe drinking water by 2015 (WHO and UNICEF, 2010). To improve access to safe clean water, the government of Ethiopia has prepared a water and sanitation policy document as an integral part of the country's water management policy. MoWR(1999) clearly indicates the right of every Ethiopian to get access to adequate and quality water to satisfy their basic needs in order to achieve rapid socio economic development through better health care and productivity.

Efficient management of water resources for rural areas requires a full understanding of existing patterns of water demand (Nyong and Kanaroglou 1999).Demand analysis is an essential tool for the economic analysis of household behavior with consider to water use. It can assist to determine factors influencing water demand and estimate their effects. Via to a point, this study would be intended to investigating factors affecting the domestic water use of rural households'. These households use diverse water source which are unambiguously free use of water sources and purchased water sources respectively. The research would be interested in investigating household domestic water use and availability during the rainy and dry season, when water is surplus or scarce. Hence, water demand with community will be determined by a number of factors such as time of fetching water, household size, education, occupation of household head, wealth, water price and seasonal variation(quantity of water use vary between dry and rainy seasons).

The total five years (2013-2015) of financial investment for water supply was 1,100,764birr (FEDO, 2005). The annual growth of finance was 5.6percent. The incremental budget is inadequate to reduce drinking water supply. The chief cause for the district water supply hitches is lack of sufficient finance. The majority of water supply projects are by their nature needs a great capital. Moreover, most people observe water as a free good that is supplied freely. This has its own factors on the availability of improved water source in the district. Presently as in many Ethiopia districts, the Sebeta Hawas which is a local government would be responsible for constructing and maintaining rural water supply(SH Socio Economy, 2013). Raise

Accesses to water supply are necessity to satisfy household needs of water consumption. Thus, proportion of population with access to water supply was raised by a certain numbers. Regional and local government has been done investment of the water supply schemes. Hence, the district sustained to satisfy a need of residents and achieving sustainable water supply service.

1.2 STATEMENT OF THE PROBLEM

Lack of access to clean water is locked in the heart of the poverty. Even though the issue of water is observed as a general problem for both the male and the female population, female bear the greatest burden because of their social gender roles including collecting water for their households (Rose, 2009).WHO, estimates indicate 75 liters of water a day is necessary to protect against household diseases and 50 liters a day necessary for basic family sanitation. UAP specifies 15 liters per capita per day within 1.5KM distance for rural population. Access is defined as the availability of at least 20 liters of water per person per day from an improved water source within a distance of 1 km (Bates et al., 2008).The individual persons used 20 liters per day.

The populations of Sebeta Hawas woreda have a problem of clean water supply. Less than 47% of the population have access to potable water in the rural areas (SH Statistical abstract, 2013). In the woreda, 39,650 populations are connected to improved water sources. Unconnected households face deficit of water quality: the water was not supplied from improved water source that households fetch water from unprotected water source. The government of Sebeta Hawas has been considering population access to safe water supply as a main concern. The government set an objective of increasing access to water supply from 16.7 percent in 2010 to 85 percent in 2015. This is confirmed with the MDGs which aimed at reducing the proportion of people without sustainable access to safe drinking water by 50% by 2015. In the district, access to an improved water supply residue a main distress. Although, the district has been intended to provide safe water to all, many rural households fetch water from unprotected water sources.

Potable water supply is one of the main problems in the woreda. The water sources were not developed for household consumption. Even if, efforts made by the woreda to enhance drinking water supplies that couldn`t satisfy the needs of a communities. The improved water source was insufficient (in terms of its quantity and quality).The improvements in water supply in terms of quality and quantity have not been realized in the district. Many rural households collect water from unimproved water sources. The improved water sources were not adequate which fulfill the needs of water demand. Even though, household require quality and quantity of potable water; they meet the problem of access to drinking water. The woreda own plentiful water resource but the availability of improved water source is restricted.

In the woreda, the population accessed to water supply is inadequate. Thus, investigate the problem of access to domestic water use in the question form. Why access to water supply is insufficient? Water demand increasing? What are the determinants of domestic water use? What are the major challenges to get access to water supply? These questions are the core problems of the study areas how to investigate access to potable water. Therefore, this study is designed to examine water use and access to water supply for rural households.

1.3 OBJECTIVES OF THE STUDY

1.3.1 General objective:

The general objective of this study is to examine the status of rural households` access to domestic water use and its determinants in the Sebeta Hawas Woreda.

1.3.1 The specific objectives are:

- to describe the major source of water supply in the Sebeta Hawas Woreda ;
- to examine the quantity of domestic water use of households in the rainy and dry seasons;
- to examine the extent to which current level of clean water supply satisfies the needs of the residents;
- to examine the factors which affect domestic water use of residents.

1.4 SIGNIFICANCE OF THE STUDY

Providing baseline information on access to rural households' water supply so as to take measures to fills gap in the sub-sector. The study would also aid policy-makers and executive bodies at administrative levels as an input in policy making and make easy its execution in the sub-sector.

1.5 SCOPE OF THE STUDY

This study distinctively focuses on access and determinants of domestic water use by rural households. The study conducted in the rural area of Sebeta Hawas woreda which was not included elements of urban water supply because of its comparatively better improved water supply than rural areas. Although Sebeta town is the seat government of SHW, the study didn`t include it. The study only focuses on rural woreda of SH. Despite the opportunity for rural residents to use improved water source since nearby Sebeta town, people are still fetching water from unprotected river and ponds. Even though many water sources have been existed in the woreda, households` to have access to safe water for 2015 was a problem.

1.6 LIMITATION OF THE STUDY

The obstacle of this study was the availability of documented data as associated to the study and analysis of access to domestic water consumption at regional level that influence the relevant information which restricted to the study. Because of the researcher is self-sponsor, the financial constraints were occurred. The other challenge is time constraint. In the given time to collecting the required data from the entirely rural population was difficulty. Finally, since some rural villages don`t have road facility which is not suitable for transport. So, it was essential to travel on foot up to 1hours to 1.5 hours for a work.

CHAPTER TWO

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Water: basic households` natural resource

The majority of human uses require fresh water. Water is the most essential natural resource in the world, without it, man's existence will be impossible. Next to air, water is the most esteemed requirement for survival on earth. The search for domestic water has been man's utmost concern since the beginning of Civilization. Bustanmante et al. (2004) defined domestic water as commonly understood to include the water needs of families for drinking, cooking, washing and sanitation/hygiene.

Water is a prime natural resource and a basic human need. Without having the access to potable water every human's activity is meaningless and the right to use other resource will be violated (Pratiksha et al, 2012). Access to water is a fundamental need and constitutes one of the most important human rights. People's lives and livelihoods depend on water. Demand for clean water increases continually in line with world population growth (WSSCC, 1990).Fresh water is a natural resource with high significance to the overall development contributing its lion share to all sectors including agriculture and for domestic supplies (Michael H., 2006). The management and protection of regional, national and international fresh water sources have reached a crucial period (Gleick, p.etal, 2001). By its very nature and multiple uses, water is a complex subject.

Natural resources are materials and components (something that can be used) that can be found within the environment. Every man-made product is composed of natural resources (at its fundamental level). A natural resource may exist as a separate entity such as fresh water, and air, as well as a living organism such as a fish, or it may exist in an alternate form which must be processed to obtain the resource such as metal ores, oil, and most forms of energy. There is much debate worldwide over natural resource allocations; this is partly due to increasing scarcity (depletion of resources) but also because the exportation of natural resources is the basis for many economies (particularly for developed nations).

Water can be considered a renewable material when carefully controlled usage, treatment, and release are followed. If not, it would become a non-renewable resource at that location. For example, groundwater is usually removed from an aquifer at a rate much greater than its very slow natural recharge, and so groundwater is considered non-renewable. Removal of water from the pore spaces may cause permanent compaction (subsidence) that cannot be renewed. 97.5% of the water on the Earth is salt water, and 3% is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps (Earths water distribution). The remaining unfrozen freshwater is found mainly as groundwater, with only a small fraction (0.008%) present above ground or in the air (Scientific facts on water).

Water is a natural resource of fundamental importance. It supports all forms of life and creates jobs and wealth in the water sector, tourism, recreation and fisheries (Ntengwe, 2005). Without water life as it exists on our planet is impossible (Asthana and Asthana, 2001). It is estimated that 8% of worldwide water use is for household purposes (WBCSD).These include drinking water, bathing, cooking, sanitation, and gardening. Basic household water requirements have been estimated by Peter Gleick at around 50 liters per person per day, excluding water for gardens. Drinking water is water that is of sufficiently high quality so that it can be consumed or used without risk of immediate or long term harm. Such water is commonly called potable water. In most developed countries, the water supplied to households, commerce and industry is all of drinking water standard even though only a very small proportion is actually consumed or used in food preparation.

2.2 Access to safe water

Access refers to one's ability (i.e. monetary cost) and capability (i.e. distance, time, convenience and energy) to reach those facilities that will enhance one's living condition (Abane, 2005). The issue of accessibility also involves the facility being located within safe physical reach, being affordable and being accessible in law. Also the information on the facilities is to be made available to the users of those facilities (WWC, 2005).

Access to facilities such as potable water supply, healthcare, clothing and education can be cumbersome making some homes having little or no access to them (Moe & Rheingans, 2006). According to the estimates of WHO/UNICEF (2006), households which are found in the low income areas are over five times more likely to lack access to improved water supply than

households in the high income areas in the same country. Blakely, Hales, Kieft, Wilson, & Woodward, (2005) observed that households that earn less than a dollar a day may be almost nine times more likely to lack access to improved water or sanitation than those earning more than two dollars per day.

Access to safe drinking water in rural areas is defined by the UAP within 1.5KM 15 liters per person per day sources including hand dug, shallow, and deep, springs, streams, cisterns, ponds. Safe water is water does not biological or chemical directly detrimental to healthy. It include treated surface water and untreated but uncontaminated from protected springs and boreholes. Access to safe water is measured by the proportion of population with access to and adequate amount of safe drinking water located within a convenient distance from the user`s dwelling. WHO/UNICEF Joint monitoring programme defined at country level "Access" is interpreted as actual use by population. Access to water is in urban area a distance of not 200 metres from a home to a public stand post may considered a reasonable access .In rural areas, reasonable access implies that a person does not have to spend disproportionate fetching water for the family needs. The reasonable access as the availability of at least 20 liters per person per day from a source within one kilometer of the user's dwelling (WHO/UNICEF, 2000).

Safe drinking water is essential to humans and other life forms even though it provides no calories or organic nutrients. Access to safe drinking water has improved over the last decades in almost every part of the world, but approximately one billion people still lack access to safe water and over 2.5 billion lack accesses to adequate sanitation. There is a clear correlation between access to safe water and gross domestic product per capita. However, some observers have estimated that by 2025 more than half of the world population will be facing water-based vulnerability. Chartering our water future report, issued in November 2009, suggests that by 2030, in some developing regions of the world, water demand will exceed supply by 50%. Water plays an important role in the world economy, as it functions as a solvent for a wide variety of chemical substances and facilitates industrial cooling and transportation. Approximately 70% of the fresh water used by humans goes to agriculture (Baroni and Berati, 2007).

Safe drinking water matched with improved sanitation contributes to the overall wellbeing of people; it has significant bearing on infant mortality rate, longevity and productivity. However, the majority of the world's population in both rural and urban settlements does not have access to safe drinking water. According to WHO (2006) only 16% of people in sub-Saharan Africa had access to drinking water through a household connection (an indoor tap or a tap in the yard). Not only their poor access to readily accessible drinking water, even when water is available in these small towns there are risks of contamination due to several factors like inappropriate waste disposal and lack of water supply infrastructure such as pipe line for water(Mengistu, 2008).

Access to safe water is the share of the population with reasonable access to an adequate amount of safe water (UN-HABITAT, 2003). Safe water includes treated surface water and untreated but uncontaminated water such as from springs sanitary wells and boreholes. An adequate amount of water is that which is needed to satisfy metabolic, hygienic and domestic requirements usually about, 20 litters of safe water per person per day. This minimum quantity however vary depending on whether it's an urban location or rural and whether warm or hot climate. Perhaps this is why the African Water Development Report (2006) that described basic human water need to be 20 to 50 liters of uncontaminated water daily.

Access to water is a prerequisite for health and livelihood, which is why the MDG target is formulated in terms of sustainable access to affordable drinking water supply. The availability of improved and quality water supply and sanitation infrastructures are widely recognized as an essential component of human rights, social and economic development (ADF, 2005).

The poor and marginalized people living in rural and peri-urban settlements are most in need for improved and safe drinking water, appropriate forms of sanitation and access to water for other domestic purposes (Crow, 2001). The WHO (2000) reports that polluted drinking water causes about 1.8 million people die from diarrheal diseases annually worldwide. Ethiopia is a country in which the water supply and sanitation infrastructure endeavors are still low.

Though water is essential to life, only less than a percent of the world`s total supply is accessible fresh water creating its scarcity in some parts of the world (Cunningham, 2004). This is also coupled with the contamination and pollution of water resources, especially surface water in some areas by human activities. The result of this affects the availability of fresh water which

then will have implications on its access. Groundwater is a safer source compared to surface water sources since it is protected from direct contamination and filtered through the soil (VanCalcar, 2006).

Access to sufficient potable drinking water has been declared "a fundamental human need and, therefore, considered as a basic human right" (Annan (2002), quoted in WHO 2002). Encumbered by the continuous increase in the world's population, the security of water has raised much attention in the world. Low income and middle income countries are especially faced with the competition of access to facilities because of rising population numbers which affect the poor (UN-Habitat, 2006). Annan (2000) warns that the world's security is dependent on solving the water crises without which seeds of violence may sprout. Inequitable access to water and sanitation is usually the result of disparities in fresh water resources, income, power and sometime institutional capacity which is mostly present within countries (Moe & Rheingans, 2006). This disparity exists between the rural and urban communities concerning access to basic utility services such as water (Sarpong, 2004).

This is because many people may lack the ability (i.e. in terms of monetary cost) or economic power to access a utility. The issue of disparities in access to water is complex. There is, therefore, the need to improve financial sustainability in the provision of these basic services to all. Universal access to affordable household water treatment such as the Pure Home Water treatment system, and safe storage of water can be provided for those who still rely on existing but unimproved water sources such as water from rivers or streams (Moe & Rheingans, 2006; VanCalcar, 2006).

2.3 Water accessibility

To understand the best location, define accessibility and this is probably the most complex and important of all tasks facing those concerned with the provision of any social service. The task is a two dimensioned problem organizing a limited set of resources in a way, which is efficient, yet equitable. In real terms, it ultimately declines to the basic dilemma of having to rationalize supply of services yet ensuring improved accessibility of these services to the consumer (Adeyemo 1989). Accessibility therefore connotes physical availability of a service or facility. It establishes the extent to which factors like distance, time and cost have decayed. Optimum

accessibility in the case of water means effectively over coming access indicators of distance, time and affordability (Alaci and Alehegn, 2009).

Accessibility must be seen within the context of the ease with which people can obtain the services of a facility and function. Accessibility increases with decreasing constraint both physical and social. According to Adeyemo and Afolabi (2005), accessibility is the balance between the demand for and the supply of consumer services over a geographic space and narrowing or bridging the gap between geographic spaces is the all significance of transport. Access to essential resources and services has come to be recognized as positively related to development such that inaccessibility or lack of access is cited as lack of development or symptom of underdevelopment (Ayeni, 1987 and Moseley, 1979 cited in Alaci, 2004). To the extents that improved access to essential services has become an accepted part of the rubrics or measure of development and standard of living (Alaci and Alehegn 2009).

According to WHO (2004), they are basic indicators for measuring water accessibility. These indicators show four paramount levels of water accessibility that include optimal access, intermediate access, basic access and no access. These are indicative of the level of water availability, which is a measure of the quantity available for use. Basically, they reflect the extent to which accessibility challenges such as time, distance and affordability are formidable or otherwise.

The affordability of water has a significant influence on the use of water and selection of water sources. Households with the lowest levels of access to safe water supply frequently pay more for their water than households connected to a piped water system. The high cost of water may force households to use small quantities of water and alternative sources of poorer quality that represent a greater risk too (Public Health Protection, 2000). Private access to tap water is the cheapest for the consumer. Dependence on a shared standpipe increases prices almost four times. Private water delivery through tanker service (or sachet or bottled water) is the most expensive and tanker water delivery costs many times the tap water price. Thus, the consumers paying the most for water are the ones with the lowest income (Alaci and Alehegn, 2009).

Time and distance traveled to fetch water are also key indicators of water accessibility. To most communities of Africa, long distance travel to fetch water is common. Hence, they spend much

time and money. According to WHO (2004) standards if households travel more than 200 meters far away from house in urban, there is no access. Distance travel to fetch water is also one of the indicators of water accessibility. WHO standards in relation to time, more than 30 minutes no access 5 minutes - 30 minutes basic access and within 5 minutes intermediate access.

Water availability is affected to a larger extent by environmental factors that may result from hydrological changes and may have short-term variations. In this case, water is viewed as a natural resource that has to be managed and sustainably used. Hence, the unsustainable consumption of water may have long-term impacts by reducing available water to communities concerned. Human factors also influence water availability in that available water would have to be harnessed and distributed to ensure adequate and reliable flow.

Water accessibility considers water as a commodity and ensures that households have full or firm control of the available water. Access to this commodity therefore depends on its physical location and timely availability. Water usage relates to "entitlement rights" of households, required for basic needs (i.e., for drinking, cooking, hygiene and sanitation) and other purposes such as watering livestock and backyard gardens. In addition to these, the quality of water is important because households cannot be secure from water-borne and water-related diseases when its quality is questionable.

Easy accessibility, reliability and timely availability of adequate safe water to satisfy basic human needs ensure water security (Ariyabandu, 1999). This implies that households are able to obtain the required quantity of suitable quality water for basic needs and other economic activities (Ratnaweera, 1999). The extent to which these factors interact determines water security conditions of households, nations and regions at a point in time. Nevertheless, water insecure households adopt various coping strategies such as the use of multiple water sources and commuting long distances to access water. Coping with seasonal and periodic water scarcity is costly due to investments in water storage equipment, water treatment (i.e., boiling water, purchase of chemicals and filters to purify water) and opportunity costs of time spent fetching water.

2.4 Domestic water supply

Domestic water is defined as water used for all usual domestic purposes including consumption, bathing and food preparation (WHO, 1993:2002). For each of this domestic consumption a certain quantity of water must be available. But it is problematic to identify a clear-cut minimum amount of water for each activity. For the sustainability of life a minimum quantity of water is needed by human body. The requirements with regard to the adequacy of water apply across all these uses and not solely in relation to consumption of water. Although this broad definition provides an overall framework for domestic water usage in the context of quality requirements, it is less useful when considering quantities required for domestic supply.

Sub-dividing uses of domestic water is useful in understanding minimum quantities of domestic water required and to inform management options. In the 'Drawers of Water' study on water use patterns in East Africa, White *et al.* (1972) suggested that three types of use could be defined in relation to normal domestic supply: Consumption (drinking and cooking),Hygiene (including basic needs for personal and domestic cleanliness) and amenity use (for instance car washing, lawn watering). In updating the Drawers of Water study, Thompson *et al.* (2001) suggest a fourth category can be included of 'productive use' which was of particular relevance to poor households in developing countries. Productive use of water includes uses such as brewing, animal watering, construction and small-scale horticulture

The first two categories identified by White *et al.* (1972): ‘consumption’ and ‘hygiene’ have direct consequences for health both in relation to physiological needs and in the control of diverse infectious and non-infectious water-related disease. The third category: ‘amenity’ may not directly affect health in many circumstances.

Safe drinking water is the birthright of all humankind as much a birthright as clean air (Rao2002) while access to clean water can be considered as one of the basic needs and rights of a human being. Health of people and dignified life is based on access to clean water (Korkeakoski, 2006). Alaci and Alehegn (2009) stated that, water is important in a number of ways; these include domestic and productive uses. Domestic water use takes the form of drinking, washing, cooking and sanitation, while productive water uses includes those for agriculture, Beer brewing, brick making etc.

According to Water Utility Partnership (Africa, 2003), the primary goal of all water supply utilities is to provide customers with a 'private' connection to the piped water supply network. For many public officials, policy makers and politicians a household or yard connection (hereafter referred to as a private connection) is considered the most satisfactory way to meet the key objectives of public health objectives: by ensuring better quality and access ,Commercial objectives: by facilitating cost recovery and revenue generation, Social objectives: by improving access for the poorest and enhancing security and safety and Environmental objectives: by enabling better demand management and water conservation.

Waterborne diseases and the absence of sanitary domestic water are one of the leading causes of death worldwide. For children under age five, waterborne diseases are the leading cause of death. At any given time, half of the world's hospital beds are occupied by patients suffering from waterborne diseases. According to the World Bank, 88 percent of all waterborne diseases are caused by unsafe drinking water, inadequate sanitation and poor hygiene.

Adequate potable water supply for domestic use especially is often used as a yardstick for measuring the level of the socio-economic development and health status of human communities. To support a country's population and economic goals, the requirements is to have a steady supply of high quality fresh water (NAS, 2006). Socially, reliable potable water provides relief for those involved in its access such as women and children (Essaw, 2001). Individuals, families and industries all depend, to a large extent, on the provision of clean, potable and affordable water (Eguavoen, 2008). The water required for each personal or domestic use must be safe and therefore be free from micro-organisms, chemical substances and radiological hazards that may constitute a threat to a person's health. It must also be acceptable in terms of colour and odour so that individuals will choose it rather than polluted alternatives that may look more attractive (WWC, 2005).

As a strategy for ensuring environmental sustainability, the seventh MDGs (2000) note the need to make water in available quantities to all. That is, to reduce by half the number of people without access to clean water by 2015. This is imperative because its helps to protect both environmental and living conditions of people through environmental management. This directly links issues about management of the environment to economic growth and poverty reduction by involving the participation of the members in the community who will be accountable to protect

the environment using simple management skills. This includes rehabilitation and biodiversity conservation sites (Stockhlom Environmental Institute, 2008).

2.5 Water demand and its management

A common characteristics of water demand in urban areas worldwide is its relentless rise over many years and projections of continues growth over coming decades .The chief influencing factor are population growth together with changes life style, demographic structure and possible effects of climate change .Meeting this increasing demand from existing resource is a struggle, particularly in water stressed or water scarce regions .Worldwide there is considerable pressure from the general public and some government to minimize the impacts of new supply project (e.g. building new reservoirs) implying emphasis should be shifted toward managing water demand by best utilizing the water that is already available.(NAS,2009)

Water demand management involves the adoption of polices or investment by a water utility to achieve efficient use by all members of the community. Demand management measure can be short or long term depending on the needs of the community served by the water utility .Strategic planning is a key aspect of a successful demand management strategy. It involves understanding the constraints, analyzing how much water is used, when, by whom, for what purpose and at what level of efficiency; determining the potential reduction in water use that can occur through improvement to water using equipment and behavior.

Water management program involves decision about how should be best allocation to receive the greatest public return from score resources. The full value of water needs to be recognized to allow informed decision for public policies related to water supply and quality. This is of particular importance, because these policies can have significant economic consequence for household communities and industry. If water is allocated to less valued uses, water quality will decline, ground water basins are over exploited and floods and drought can destroy properly and take sever toll on life.(Butler and Fayyz, 2006).

In short, demand management aims at achieving desirable demands and desirable uses. It may include measures aimed at stimulating water demand in sectors where current use is undesirably low. This is the same thing as making the right choice about water utilization. Hence, “water as an economic good” is fully compatible with the concept of “demand management” if well interpreted.

2.6 Water scarcity

Water scarcity is the lack of sufficient available water resources to meet the demands of water usage within a region. It already affects every continent and around 2.8 billion people around the world at least one month out of every year. More than 1.2 billion people lack access to clean drinking water. Water scarcity involves water stress, water shortage or deficits, and water crisis. Water scarcity can be a result of two mechanisms: physical and economic water scarcity, where physical water scarcity is a result of inadequate natural water resources to supply a region's demand, and economic water scarcity is a result of poor management of the sufficient available water resources. Causes of water scarcity are either natural or induced by the actions and/or inactions of man, resulting in permanent or temporary effects (Falkenmark, 1999; Pereira et al., 2002).Several degrees of water scarcity identified include absolute, life-threatening, seasonal, temporary and cyclical water scarcity (Pereira et al., 2002).

Countries with total water withdrawals greater than 50% of the available water resources are said to experience absolute water scarcity (Secklar et al., 1999; Lanka Rainwater Harvesting Forum [LRHF], 1999) whilst economic water scarcity prevails if projected water demand is less than 50% of its available water resources but more than twice the current withdrawal levels (ibid, 1999). Winpenny (1994) attributes high growth in population and food demand as major causes of water scarcity, alongside human behaviour, social customs, institutions and government policies as influencing factors. Growth in urbanization especially in developing countries, industrialization and irrigation are partly responsible for water demand increases at the domestic, commercial and industrial levels. The contamination of existing water supplies, modifying landscapes and land uses, financial and institutional obstacles, and the failure to manage demand have also been mentioned.

There is no widely acceptable definition of water scarcity such that the term water shortage has been used synonymously with water scarcity. When water scarcity is man-induced but with temporary water imbalance including groundwater and surface water over-exploitation, degraded water quality and often associated with disturbed land use and altered carrying capacity of the ecosystems, it is referred to as water shortage (Pereira et al., 2002). Thus, water shortage describes a situation of absolute shortage where low levels of water supply do not meet the

necessary minimum requirements for basic needs (ibid, 2002). The inability to sustainably manage water shortage may result in desertification, a permanent situation that is difficult to deal with (ibid, 2002).

Water stress is analogous to the term "drought" (ibid, 2002) and a symptom that points to the presence and consequence of water shortage and scarcity. It manifests itself in growing conflicts among water users (both domestic and industrial), unreliability of water sources, crop failures and food insecurity. Whilst water stress acts as a potentially serious constraint to development (Winpenny, 1994), the Food and Agricultural Organization (FAO) views water shortage as a major drawback to the socio-economic development and environmental protection.

Winpenny (1994) considers water scarcity as an imbalance between supply and demand under prevailing institutional arrangements and/or prices; an excess of demand over available supply; a high rate of utilisation (expressed as a percentage of total available water resources) compared to available supply especially when the remaining supply potential is difficult or costly to tap. Though water scarcity describes water demand vis-à-vis its availability in time and space, interpretation of "scarcity" as a situation where water is insufficient to meet normal requirements may be unhelpful to policy makers and planners.

To further conceptualize the problem, Kulshreshtha (1993) suggested a comparison of water withdrawals alongside annual availability to give different scenarios of water scarcity situations. Pereira et al. (2002) thus defined water scarcity as a situation where water availability in a country or region is below 1000m3 per capita per year whilst an amount below 500m3 per capita per year is regarded as severe water scarcity. Internal water resource availability for countries like Kenya, Rwanda, Tunisia and Algeria, for example, are below the 1000m3 per head and have water use levels also below this level (ibid, 2002). Kulshreshtha (1993), Engelman and Leroy (1995) and WRI, (1996) add that a more realistic measure of water scarcity should include water inflows from other regions and countries and current levels of water consumption. In most sub-Saharan African countries including Ghana, available water resources per capita is quite abundant where 24% and 5% of the population live in areas with annual withdrawals below 2000m3 and 1000m3 per capita respective (Pereira et al., 2002). This may be attributed to

abundant water resources, little or no irrigation development coupled with relatively low levels of water usage. Although these benchmarks may have no absolute significance, water scarcity is considered a relative concept that can surface at any level of supply depending on demand and institutional factors.

A quantitative measure, "criticality ratio", to capture water scarcity stress at the basin level has been suggested by Alcamo, Henrichs, and Rösch, (2000) and Raskin (1997) as cited by Rosegrant (2002). A high ratio of water withdrawals to total renewable water implies more intensive use of river basin water that results in degraded water quality for downstream users. Although subjective, a criticality ratio greater than or equal to 0.4 is considered "high water stress" and 0.8 as "very high water stress" (Alcamo, Henrichs, and Rösch, 2000).These concepts focus only on a single component of water security, and that is water availability. Household water security as a unique concept has been defined variously by different researchers based on research interests or perceptions. A simple definition is the ratio of water supply to water demand, where security is achieved when the ratio is greater than unity, implying water surplus. Ariyabandu and Dharmalingam (1997) defined household water security as "having adequate domestic water supply, so that the productive life of peasants can be sustained". Thomas (1998) fine-tuned this definition to mean the attainment of both Absolute Water Security (AWS) and Design Water Security (DWS), where AWS is the quantity of water reliably supplied to perform culturally normal life whilst DWS is the quantity of water reliably supplied to achieve the designed daily requirement of water.

What determines water security, according to Ratnaweera (1999), is the ability of households to obtain the required quantity of suitable quality water for drinking, personal hygiene, other domestic purposes and other economic activities.These definitions focus on quantity parameters and ignore qualitative determinants such as accessibility and quality. Incorporating quality issues, Webb and Iskandarani (1998) consider "access by all individuals at all times to sufficient safe water for health and productive life" as constituting water security. This view ignores the timely availability and reliability of supply. The interpretation of the term "safe water" is subjective and therefore debatable as "safe water" could connote cultural safety, clinical safety, and perceptional safety (Ariyabandu, 2001) or even minimum pollutant standard (LRHF, 1999).

According to the World Health Organization (WHO, 1996a), "safe water" includes untreated water from protected wells, springs and wells. A definition by Ariyabandu (2000) expresses household water security as "accessibility, reliability and timely availability of adequate safe water to satisfy basic human needs", leaving the interpretation of "safe water" to individual judgement. Abrams (2001) perceives water security as a situation of reliable and secure access to water over time. This view has the perpetuity of water supply or sustainability in mind although silent on water quality. In the words of Winpenny (1994) "The essence of water security is that societies should have sufficient access to water or that they should have the means to limit the damage caused by shortages".

2.7 Water supply in Ethiopia

Ethiopia has 12 river basins with an annual runoff volume of 122 billion m3 of water and an estimated 2.6 - 6.5 billion m3 of ground water potential. This corresponds to an average of 1,575 m3 of physically available water per person per year, a relatively large volume. However, due to large spatial and temporal variations in rainfall and lack of storage, water is often not available where and when needed (IWMI, 2007). Only about 3% of water resources are used, of which only about 11% (0.3% of the total) is used for domestic water supply (WRI, 2010).

Access to water supply in Ethiopia is amongst the lowest in Sub-Saharan Africa. While access has increased substantially with funding from foreign aid, much still remains to be done to achieve the MDG of halving the share of people without access to water by 2015, to improve sustainability and service quality. Some factors inhibiting the achievement of these goals are the limited capacity of water bureaus in the country's nine regions and water desks in the 550 woredas; insufficient cost recovery for proper operation and maintenance; and different policies and procedures used by various donors, notwithstanding the Paris Declaration on Aid Effectiveness(WHO/UNESCO,2010).

In 2001 the government adopted a water and sanitation strategy that called for more decentralized decision-making; promoting the involvement of all stakeholders, including the private sector; increasing levels of cost recovery; as well as integrating water supply, sanitation and hygiene promotion activities. Implementation of the policy apparently is uneven.

In 2005 the government announced highly ambitious targets to increase coverage in its Plan for Accelerated Sustained Development and to End Poverty (PASDEP) for 2010. The investment needed to achieve the goal is about US$300 million per year, compared to actual investments of US$39 million in 2001-2002. In 2010 the government presented the equally ambitious Growth and Transformation Plan (GTP) 2011-2015, which aims at increasing drinking water coverage, based on the government's definition, from 68.5% to 98.5%[MoFED: GTP, 2010] While donors have committed substantial funds to the sector, effectively spending the money and to ensure the proper operation and maintenance of infrastructure built with these funds remain a challenge.

According to MoWR(2005a and b) the coverage of safe water in the year 2005 for urban areas of Ethiopia was 80 % while the rural coverage was 35%. However, when it comes to household connection these figures significantly drop to 32% and % for urban and rural areas respectively (WHO and UNICEF, 2006). In additions as noted by MoWR(2005a and b) the quality and quantity of water available do not meet demand and for supply at on appropriate time when consumers should get service. Moreover, the physically powerful urban bias on the part of succeeding government since the early 1970s has kept back water supply savings in the rural areas, quite low. Accessible information in the water treatment of the country exposed that; urban people in the country had improved access to water supply service than rural areas.

2.8 Empirical literature review

Regarding the supply side, economic studies have emphasized the importance of improving project identification, design and construction, of understanding the institutions providing water and their tendency towards selecting capital-intensive enterprises and neglecting maintenance schemes, and of establishing strategic links between the water investment sector and other macroeconomic policies (Howe and Dixon 1993; Rogers et al. 1993).

On the demand side, the economic literature focuses on the valuation by households of different water sources and the analysis of determinants of water demand. Several studies conducted in developing countries over the past ten years have tried to evaluate the willingness to pay (WTP) for improved water supply by applying the contingent valuation approach (Whittington et al. 1990, 1991; Atlaf et al 1993, 1994; Briscoe et al. 1990; World Bank Water Demand Research Team 1993). The empirical results of all these studies show that the willingness to pay for improved water service does not depend solely on income, but equally on the characteristics of

both the existing and the improved supplies. Income is often not the main factor determining water demand. The share of income that a household is willing to pay for water can vary widely – from 0.5% to 10%. Moreover, income elasticities of demand for access to improved water services have been estimated to be very low, for example, 0.15 in Brazil, 0.14 in India, 0.07 in Zimbabwe (World Bank Water Demand Research Team 1993). Furthermore, empirical analysis showed that more educated households are willing to pay more for improved water supplies; and that gender was a statistically significant determinant in WTP for improved relation to the quality of water. Madanat and Humplick (1993) actually implement an approach that takes Merret's suggested direction, considering the conditional demand for water by households according to each specific use within a multiple-stage-analysis framework, assuming that households only use one source for each specific use. This assumption is problematic, however. In the household survey for Ghana, for example, the majority of households use several sources for one activity, and water from one source is typically used for several activities.

Teshome (2007) conducted study on determinants of household water demand: case of Mekelle-Ethiopia. According to finding the educational level of a house head is positively related with the per capita daily water consumption. Households with less educated head consume less water than a house hold whose head is more educated. This is because the higher the educational level of ahead of family, the higher the awareness about the benefits that could be gained from water. A study made by Teshome (2007), revealed that there is a positive relationship between monthly income and per capital daily water consumption. This result confirms with economic theory which states that an individual's demand for a particular commodity depends on his/her income and quantity demanded are positively related, except in the case of inferior goods. The result of the survey shows that higher income groups have higher per capital daily water consumption than lower income group.

Dessalegn (2012), conducted study on factors determines residential water demand in North Western Ethiopia, the case of Merawi. According to finding monthly expenditure of a house hold was found to have a positive relation with the per capita daily water consumption of house hold because family members of better household are more likely to have frequent bath, showering, frequent washes of cloth and more water for cooking as compared with worse off house hold

taking in to consideration the household life style and sanitation preference of better- off house hold. One unit increase in age (one year) the daily per capita consumption decreases. It terms of sex female headed households will have lower per capita daily water consumption than the male headed households.

Arouna and Dabbert (2009) carried out a study on the determinants of domestic water use by rural households without access to private improved water sources in Benin. According to the findings, time required for fetching water negatively affected water demand. In addition, water demand from purchased sources was found to be price inelastic among the wealthier households. In support of these findings Sandiford et al.(1990) showed a positive relation between wealth and water use. In this research it was assumed that poverty negatively affects water use because poor people cook less and often have less clothing to wash.

Arouna and Dabbert (2009) found village population having a negative sign and was significant for free and purchased water at the10 percent and 5 percent levels, respectively. This shows that people in villages with more inhabitants consume less water. The study also established that the time required for fetching water positively affects purchased water demand implying that the quantity of purchased water used increases with the time required for fetching water. In the same study, Arouna and Dabbert (2009) found out that household size positively affects both free and purchased water demand. Moreover, the variable ratio of children to adults had anegative sign. This seems to show that a child uses less water than an adult. Last but not least, water price was negatively related to water consumption for households that use purchased water and those that use both free and purchased water. Nevertheless, the coefficient of this variable was not significant.

Asante et al. (2002) analyze the access to different types of drinking water sources and the choice among sources for households in the Volta Basin in Ghana. They also provide an analysis of water-related diseases and relate migration to water access in the region. Their study finds that between 25-75 percent of households in the region use improved water sources. They also find a higher probability of out-migration in communities with scarce, low-quality drinking water sources and that education and household income are explanatory factors for households using improved water sources.

Occupation of household head has also been shown to be one of the significant determinants of the amount of domestic water use (Acharya and Barbier 2002 cited in Arouna, et al 2009).Thus in this study, it was hypothesized that households in paid employment and self-employment will be more likely to opt for non free water sources while those in unpaid family work will be more likely to opt for free water source. This is based on the demand theory which states that, as the price of a good increases, the demand for that good will,ceteris paribus, decrease (e.g., Zekri and Dinar 2003; Froukh 2001).Indeed,Pattanayaket al(2006 cited by Kanyoka, 2008) results of the linear regression model to assess the determinants of water demand showed that poverty and costs of water as the main significant factors which affect the demand for water among households. Therefore, it is expected that unpaid family work will negatively influence the demand for paid water sources dueto lack of adequate sources of income. In relation to household location and choice of water sources, Stefanie's (2005) research in Ghana found household location as one of the supply characteristics that significantly explained differences in the use of water.

CHEPTER THREE

3. BACKGOUND OF THE STUDY AREA

3.1 Description of the study Area

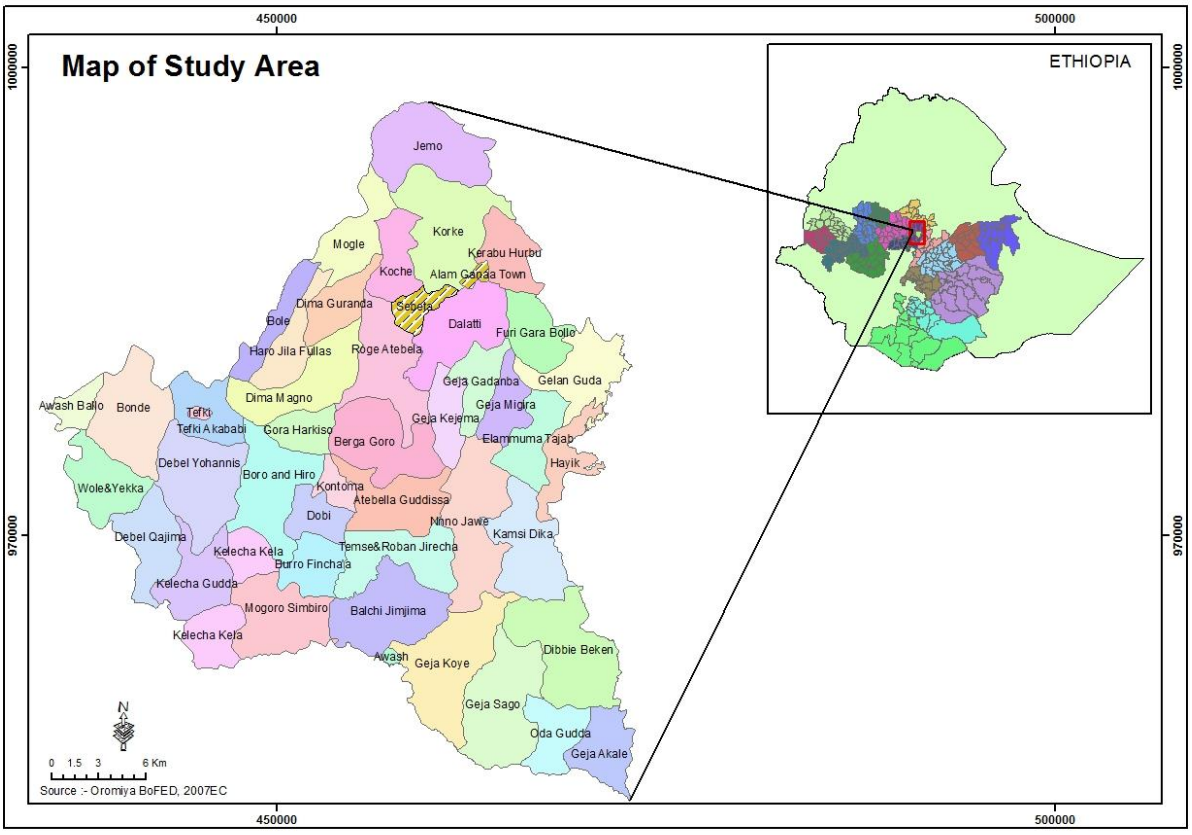
The Sebeta Hawas woreda administrative seat is existed in the Sebeta town. It is found 25KM from South –West of Addis Ababa along Jimma main road. The total surface of the district is 87,572 hectare. The district found at an altitude of 80 37' N and longitude of 380 45' E. The average elevation of the district is 2592.5 meter above sea level. The mean annual rainfall of the district is about 1033mm. its mean annual temperature is about 21.50C. The district has good vegetation covers. It is dominated with cutpurses lusitania, ollie Africana, junipers procter, ecliptic tree, cordial africana, acadia asysinica and casuatima equistofolia. However, wild life protections have been less exercised in the district. The soil type that existed in the district is black (61%), red (34%) & mixed soil (5%). The land use of the district by hectare is cultivated land 54,943.3, pasture land 3642.2, forest 2533.7, water bodies (Ponds, rivers, etc) 1475, building (residential, settlement, etc) 5907, investment 124 has been found respectively (SHFEDO, 2011).

The woreda consists of 41 rural kebeles and 2 urban centers (Tefki and Awash-Melkakunture).The district's total population census for 2007 is 133,746 of which 68,908 (51.5%) are males while 64,838 (48.48%) are females (CSA, 2007). With regards to the ratio of rural urban population of the district, the rural population accounts for 127,173 while the urban population is 6,573. Population density of the district is 2 persons per hectare. The average number of persons per household is 5 and the total number household live in the district is estimated to be 26056(WMEO, 2013)

Both Livestock rearing and crop production are the main economic activities of the majority of communities. Teff, Wheat, and Sorghum are the major crops grown in the district. The major livestock reared in the district include cattle, sheep, goats and poultry. Numerous farmers have no adequate frame land. More than 55% of the farmer households have owned less than 1.5 hectare of land-holding per a household size (SHAO, 2014). As a result, farmers produce less number of livestock's and amount of crop production.

Out of total population (133,746), 88 percent of the populations have been engaged in mixed economic activities (both crop production and livestock rearing).

The district has mineral resources such as white stone, black stone, sand stone and red sand (scoria). All and dry weather are 67KM and 91Km roads was existed correspondingly in the district. With the exception of the two urban centers and five of the rural kebeles all the rest have no access to electricity. In the district there are 40 healthy posts, 6 healthy centers, 2 rural drug venders, 16 first cycles (1-4) 30 secondary cycles (5-8)((SHFEDO, 2015)



Source: Oromia Finance and Economic Development Bureau, (2015)

3.2 Water supply situation of the District

Domestic water supply is one of the fundamental requirements for human life. Without water, life cannot be sustained beyond a few days and lack of access to adequate and potable water supply leads to the spread of disease(R-WASH, 2010). The water supply system of the district was taken up as early as 1990 from deep well located at sego kebele to serve population of 300. Presently, there are 104 water points: 47shallow well; 29hand dug well, 16deep well and 6 springs (SHWMEO, 2014)

The district has a diverse perennial river and springs. The potential availability of ground water table at shallow depth also created a great opportunity for the development of water supply. The rural water supply coverage of the woreda is very low with 16.75 percent since 2010 despite own plateful water resource ((WMEO, 2010). About 16.7 percent is the total population of the district is accessed to potable water while the rest of the communities fetch water for domestic consumption from unprotected spring and river. To this effect, the quality of water that is consumed is generally poor and can be well recognized as major transmission rout for infectious diarrhea and other disease. The Water excretes Diseases such as diarrhea and intestinal parasite are among the ten top of morbidity in the district(R-WASH, 2010).

Several water sources have existed in the woreda. However, most of rural population uses unprotected pond and rivers. Although, the major source of water supply in the district is shallow and hand dung well, inadequate for rural household consumption. In general, the rural household consumed unprotected water sources.

More than 127 water points are existed in the woreda that able to offer service for the residents. At the mid of 2015, about 45% shallow well, 27.9 % hand dung well , 15%deep well and 5% spring development that has been served to the communities respectively. About 104 water supply systems were functional whilst 23 non functional (WMEO, 2015). Four deep wells are under construction. The largest and the smallest reservoirs have total storage capacity of 100M3 and $8M^3$ respectively.

3.3 METHODOLOGY

3.3.1 Research Design

In terms of its approach, descriptive and explanatory research type would be used for this study. The purpose of this study would be to investigate access to improved and sustained water supply service regarding the quality and quantity water available for rural communities. So, the research design that would be carried out in the specific study district of Sebeta Hawas focusing on examining access to domestic water use for households in the rural areas. The Research used both qualitative and quantitative methods of data collection form its sample group as stated below.

3.3.2 Source of Data

Reliable data would be collected, from both primary and secondary sources as described below.

3.3.2.1 Source of Primary data

Household Survey: Household survey mainly focused on purchased and free use of water sources that the quantity of domestic water use between rainy and dry seasons demanded by rural households with determinants of water consumption. In order to obtain quantitative primary data for this research work, questionnaires were performed with households who live in the Sebeta Hawas woreda within study areas. The survey is intended to collect data from households' view that associated to access and determinants of domestic water use. It was conducted through to questionnaires by researcher himself. The household survey were conducted on sample households those chosen from rural kebeles using structured and semi structured questionnaire with household heads about their purchased and free use of water source to fulfill their water demand. Structured interviews to identify variables to be tested in questionnaire and Semi-structured interviews to explain themes identified through a questionnaire. The household survey entailing questionnaire collection was conducted in the woreda of Sebeta Hawas local government areas.

Hence, the description of essential and relevant data that considered to be the source of water supply, quantity of domestic water use per day(in liters), household water demand free use and purchased water source, satisfaction of water supply service, access to water source and determinants of domestic water use and other related data were gathered whether they positively influence the water demand.

Key informants interview (KII): Since the research was centered on the access to domestic water use and its determinants in the district of Sebeta Hawas it basically involves key informant's interviews. KIIs were the paramount source of detail information in qualitative type of research. KIIs utilize in acquiring primary data from interrelated official of kebele representative, Water committee, Woreda staff (Administration, Water, mineral and energy head office and expert, Healthy center administrator, development agent (DA), Finance and Economic development office head or representative and expert), Zone water resource office head and higher professional.

Via to KII, primary data pertinent to the water accessibility, household water consumption in terms of free use of water source and purchased of water sources, potable water supply services in terms of access safe water and quantity of water during seasonal variation, proportion of population supplied with potable water, distance from water source, average time to access water (in minute), education, income, occupation of household heads and etc.

3.3.2.2 Secondary data

Secondary data of the study would be collected concerning its relevant from review of documents, books, earlier research, government publication, website, regional, zonal and district water offices (strategic plans and reports)

3.3.3 SAMPLING PROCEDURES

3.3.3.1 Sampling Frame

There are 26056 households (male and female), currently reside in the rural area of the district. The district has presently 41 rural kebeles (Peasant Association). This study intends to draw 26056 households (male and female) and 41 rural kebeles which put the samples into stratified random sampling that the research examines access to domestic water use.

3.3.3.2 Sampling techniques

Among six districts and eight towns of Addis Ababa Surrounding Oromia Special Zone, Oromia Region, Sebeta Hawas woreda has been selected purposively. The reason for selecting the district was that although it is one of the woreda which have well perennial and impermanent water resource available, the potential resource was not developed to be utilized for residents of community. The woreda is proximity to the Sebeta town where different NGOs and investors etc are exists but unexpectedly it was found to be one of the woreda in the special surrounding

finfinne zone that communities fetch water for consumption from unprotected spring and rivers during last five years of WaSH.

Sebeta Hawas woreda was found to be only about 16.7 percent of the total population of the woreda is accessed to potable water supply during the last five year R-WaSH plan and first year work plan of 2010-2014. Thus, it was intentionally preferred for the study to examine the extent to which the access to potable water supply service was satisfying household water demand.

Taking the significance of this study in to account, the four-stage stratified random sampling techniques and purposive sampling techniques were utilized properly. The researcher is sorted the woreda in to four parts based on water accessibility. To part the woreda in to two clusters so that most of the household in the woreda was represented in the sample. At first stage the households surveyed in the rural kebeles were selected those consumed water from protected and unprotected sources. This selection plan was employed to comprise, for each woreda, rural kebeles with diverse level of water accessibility.

At the second stage these rural kebeles were stratified in to their respective water accessibility. In each woreda, 'Rural kebeles' were classified in two groups: rural kebeles with high level of water accessibility(fewer than 250 per persons per water point) and kebeles with low level of water accessibility (more than 250 persons per water point) based on WHO (2005) which recommended at least one water point per 250 people for adequate water. Kebeles (peasant association) were randomly selected per cluster. From each of this water accessibility three kebeles has been selected using simple random sampling techniques. Accordingly, Balchi Jimjima, Bond and Jewe, were preferred. In total, 3 rural kebeles were selected.

The third stage was the selection of village from each of the sampled kebeles. In each of the kebele there are three villages. The villages were purposefully selected based on the higher existence of the problems of the water supply that the information provided by water committee and kebele administrators. The final stage of the sampling techniques was identifying households to be interviewed. It involved simple random selection of forty households from each of two clusters. For the purpose of sampling implement comprehensive list of household heads were

established in each kebeles. Based on household list, a random selection of 40 households per rural kebeles was made in the final stage. In total, 120 household heads (male and female) were surveyed by random sampling techniques to conduct a research survey.

To attain the objectives of the study, a pretested structure and semi-structured questionnaire was organized for the sample households. The survey questions were vigilantly converted in to the local Language (Afan Oromo) earlier to the pre-testing procedure. This was assisted to express the questions successfully to the rural interviewees.

Summary of Sample size and Sampling techniques

No	Stratified Sample frame	Sample frame	Sample size	Sampling techniques
I	**Rural Kebeles Selected**			
1	Number of Rural Kebeles	41	3	Sampling techniques
II	**Rural kebele household heads**			
1	Three Rural kebele household heads	1764	120	Sampling techniques
2	**Households heads surveyed**		**120**	Sampling techniques
III	**Key informative Interview**			
1	kebele representative		3	Purposive sampling
2	Water committee		12	Purposive sampling
3	District administration office		2	Purposive sampling
4	Water, mineral and energy office expert		2	Purposive sampling
5	Healthy center administrator		3	Purposive sampling
6	development agent (DA)		3	Purposive sampling
7	District finance and economic development office senior expert		2	Purposive sampling
8	Water ,mineral and energy bureau senior expert		1	Purposive sampling
	Total		**28**	

3.3.3 Model specifications

The Logit model was utilized to analyze the factors that are influencing access to rural household water demand. The logit is the natural logarithm (ln) of odds of Y, and odds are ratios of Pi the probability of free use water source then (1 – Pi) purchased water sources.

The linear probability model can be expressed as:

$$P_i = E\left(Y = {}^{1}/_{X_i}\right) = \beta_o + \beta_1 X_s + \mu_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Equation 1 shows the cumulative logistic distribution function. Zi ranges from -∞

to +, ∞ while Pi *ranges* between 0 and 1. Assuming E (ui) = 0, as usual (to obtain unbiased estimators)

$$P_i = E\left(Y = \frac{1}{X_i}\right) = \frac{1}{1 + exp[-(B_1 + B_2 X_i]} = \frac{1}{1 + \exp(-Z_i)} \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$where\ Z_i = B_1 + B_2 X_i$

The probability of water demand of free use water source is specified as

$$\frac{1}{1 + \exp(-Zi)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2a)$$

While 1-Pi is the probability of water demand of purchased water sources is expressed as

$$\frac{1}{1 + \exp(Zi)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2b)$$

Following from equations 2(a) and 2 (b), it can be said that the probability of water demand free use of water source in relation to probability of purchased water source can be written in equation 3

$$\frac{P_i}{1 - P_i} = \frac{1 + \exp(Z_i)}{1 + \exp(-Z_i)}\ taking\ Log\ of\ odds \ln\left({}^{P_i}/_{1 - P_i}\right) = Z_i \ldots\ldots\ldots\ldots (3)$$

$\frac{P_i}{1-P_i}$ is the odds ratio infavour of free use of water source to the probability of purchased water source. Taking natural log of (3), to obtain

$$L_i = \ln\left[{}^{P_i}/_{(1 - P_i)}\right] = Z_i = \beta_1 + \beta_2 X_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

The log of the odds is not only linear in X, but also linear in the parameters. L is the Logit Model. The logit model to determine which influencing rural household water demand that would be prepared as equation 1

$$P_i = E\left(Y = {}^{1}/_{X_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots \ldots\ldots\ldots\ldots \beta_6 X_6 \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where the dependent variable (Y) = Water demand. Bearing in mind that free use of water source corresponding to Y=1 and purchased water sources corresponding to Y = 0

β_o is intercepts/constant

β_s are the regression coefficients

X_s are the explanatory variables

X_1= Household size

X_2 = Education level

X_3 = Occupation of household head

X_4 = Time for fetching water

X_5 = Water price

X_6= Distance

3.3.5 Method of data analysis

Upon successful accomplishment of the data collection work, the collected data was edited, coded and entered in to Statistical Package for Social Science Software (SPSS 20) and subsequently analyzed using both qualitative and quantitative data analysis methods. The quantitative analysis using SPSS 20 would be household size, water price, time for fetching water (in minute), water demand, distance, level of education, occupation of household heads, seasonal variation and amount of water per day to consume would be explained by descriptive statistics such as percentage, mean, standard deviation and logit model that predict the relationships between water demand and its determinants.

The qualitative information gathered via KII such as number of water sources , adequacy of water supply, reliability of water supply service is authenticated using triangulation method by cross-checking the same data from different sources.

CHAPTER FOUR

4. RESULTS AND DISCUSION

4.1 Socio Economic Characteristics of Respondents.

Utilizing the interviews survey, a total of 120 sample households were selected during the survey from areas of the woreda. From sample households, 35.8 percent were male households, whilst 64.2 percent were female. Out of male respondents, 69.8 percent were male -head of households, whilst 30.2 percent were not head of households. Female respondents were 61 percent were female head of households while the remaining 38.9 percent were not head of households. The majorities were female respondents because of two reasons:

The researchers think that the reliable data were collected from female while the burden of a water fetching is usually on the female members of household.

Assuming that female have the primarily responsibility to fetch water for household members in rural areas. The lack of water availabilities affect female than male. Thus, participation of females in the research was important.

The average household size of the total sampled households was 7.01 with a minimum of 4 household members and maximum of 10 household members. With regard to age 40 year age is the average age, with minimum of 23 years and maximum of 60 years. The occupations of the respondents demonstrate that 73.3 percent were farmers. Their livelihood depends on the mixed economic activities both crop and livestock production. For 16.5 percent households live in the district by engaging on trade activities. About 4.2 percent of civil servants of households were hired and employed in government organization. Nearly, 5.8 percent of others are that engaged on daily working, blacksmith and etc. From survey results, households' head occupation found to be relying on predominantly agricultural activities.

The education level of the respondents explained that, majority of the respondents were non literate. Virtually 56 percent of respondents in the district is non literates, those who able to read and write 22.8 percent, elementary (1-6 grades) is 10 percent, Junior (7_8 grade) 5 percent, high school (9-12) 3.8 percent and college education 2.3 percent respectively. The minimum education level achieved by the respondents was not able to read and write (non literate), while

the maximum is college education. Out of total respondents 67 households were neither read nor write.

The average monthly income of the sample households was birr 1545, which is ranging from the minimum of birr 500 to the maximum of birr 4166. Data about the income of households shows that, there is income disparity between farmers in the rural areas of the district. The monthly income variation of the sampled household is birr 3667. Efforts were also made to identify the income of sample households. Accordingly, the data was obtained from development agent of the district, household income demonstrates that there is high income variation between poor, medium and rich. Household who are poor is that cannot plough his/her arable land that rent to other person and inability to purchased improved seeds. As a result, they were persistently inadequate access to food. Medium income sampled household is who purchase improved seeds and utilize partially agricultural package. Higher income of household is who uses fully agricultural package and able to purchase improved seeds. They educate their child and protect their environmental clearness.

4.2 Source of water

Table.1 indicated that the three kebeles were examined to rely utterly up on ground and surface water to meet their household members of water demand. The alternative water supplies that utilized in the district were deep well, shallow and hand dung well, unprotected hand dung well, irrigation water, pond, river and rain water. The water sources are different from kebele to kebele. The main alternative water accessibility of Balchi Jimjima communities was unimproved water source whilst Jewe and Bonde communities both improved and unimproved respectively. In general, sources of water supplies are ground and surface water.

Table.1 indicated that up to 5.8%, 8.3 % and 10.8% of respondents described that they depend on deep well, shallow and hand dung well in the rainy seasons whilst 10%, 11.7% and 14.2% in the dry seasons respectively. About 4.2% and 5% households depend on unprotected hand dung well both in the rainy and dry seasons. Up to 12.5%, 20% and 13.3%, respondents' households rely on irrigation water, pond and river in the rainy seasons whilst 17.5%, 26.7% and 15 % 25% in the dry seasons correspondingly. Nearly, 25% depends on the rain water in rainy seasons. Majority of respondents were used surface water 70.8percent and 59.2 percent as their main

alternative sources in the rainy and dry seasons respectively. Out of total of 120 household surveyed, about 29.2 percent and 40.9 percent household water use was ground water in the rainy and dry seasons respectively.

The household water supplies were provided either by government or community of residents. The rural household water uses were an improved and unimproved water source which is supervised by the state and community of residents with a percentage of 43 and 77 respectively. The respondents described that in the district numerous households were fetch water from surface water both in the dry and rainy seasons respectively. The source of water supply in the district is shared sources. Even if rural households` consumed surface water, when they had required water from these sources were delay to accessible. This implies that lack of access to surface water within a reasonable walking distance.

Table.1 Water supply sources used by sampled households

	Alternative water sources	Rainy seasons		Dry seasons	
		Frequency	Valid percent	Frequency	Valid percent
Valid	Deep well	7	5.8	12	10
	Shallow well	10	8.3	14	11.7
	Hand dung well	13	10.8	17	14.2
	Unprotected hand dung well	5	4.2	6	5.0
	Irrigation Water	15	12.5	21	17.5
	Pond	24	20	32	26.7
	River	16	13.3	18	15
	Rain water collection	30	25		
	Total	120	100	120	100

Source: Household survey

Although a number of water sources have been existed in the district, were not developed for household consumption. Investment of water supply systems for community residents was less that meets to water demand of household. Lack of such investment, households have been consumed the available water sources for their domestic consumption of water. The interviewed

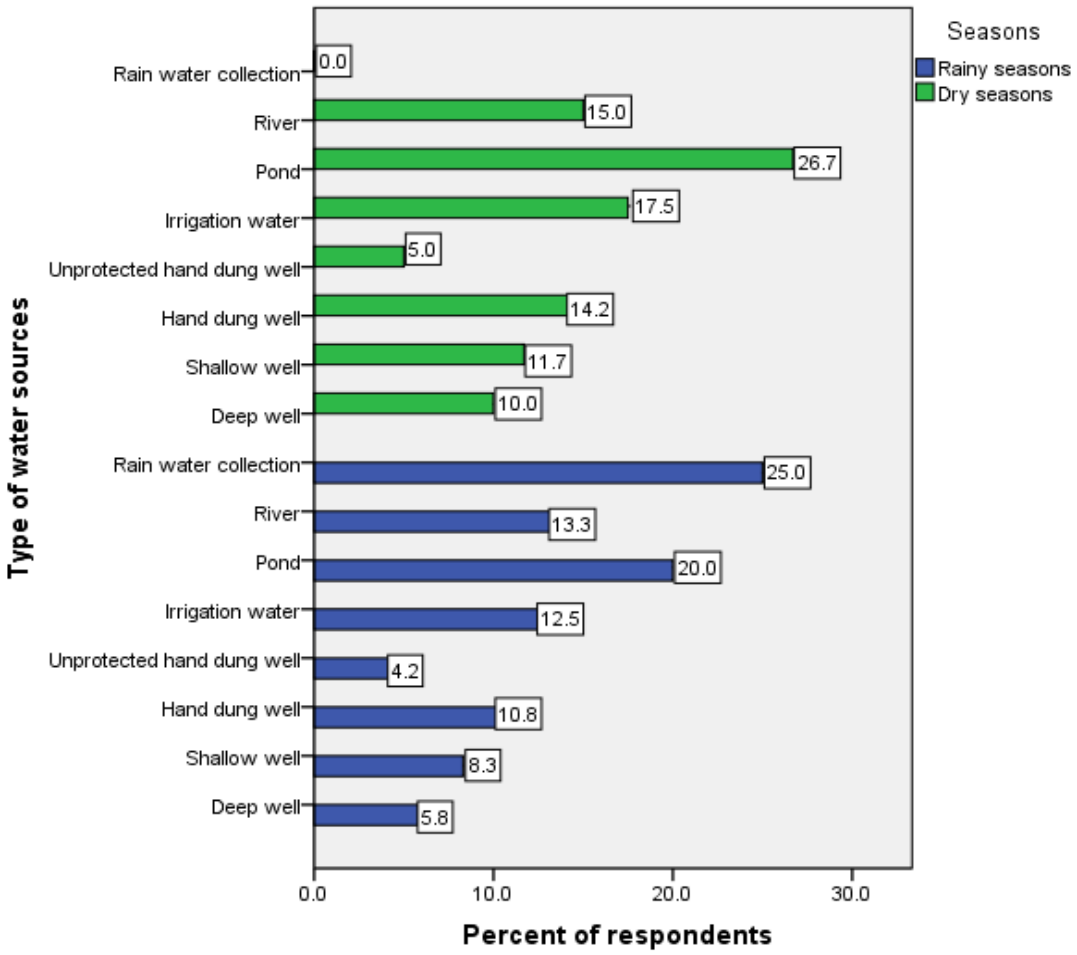
surveys found to be water from numerous sources are often consumed for domestic water use. The source of water use is starting from deep well to rain water collection.

During dry season's irrigation water, pond and river were the main water source of many rural households. Due to, commonly utilizes these sources, they were very congested. More than two-third of households uses unimproved water. Because of ponds were ceased communities save consumption of water from it. Next to pond the household was consumed river as water supply source during rainy and dry seasons. When the pond had been dried household launched to consume river water. However, the river far from the household house, they fetch water from river during dry seasons. In rainy seasons some households preferred river more than pond and rain water collection as their water consumption. Rain water is commonly consumed by 25 % in the rural area as main water source during rainy seasons. During the dry seasons the pond starts to dry up and the water availability can be become critical issues.

Figure 1: shows, that the majority of household respondents responded that source of water supply in the district both in the rainy and dry seasons are surface water. The water sources are mainly unprotected source (Pond, irrigation water and river). However, these sources of water supply had not been meeting the demand of household water consumption. The aggregate percentage of household respondents of surface water consumption was larger than ground water. Even if, the ground water of the district is considered as perennial water sources, its utilization were half of the surface water. These express, that although district has an opportunity to development in ground water, its accessibility were inadequate.

Figure1: demonstrated that consumption of ground water source increases from 29.2 percent to 40.8 percent rainy seasons to dry seasons whilst surface water decreases from 70.8 percent to 59.1percent. This implies that majority of ground water is an improved water sources that household needs for consumption. Household have altitudes of a ground water are protected from contamination which reduces water born related disease.

Figure 1: Alternative water sources in the rainy and dry seasons



Source: Household Survey

Households responded that the main alternative water sources of households` in the dry seasons is pond whilst in the rain season rain water collection is important source (Fig.1). Average percentage of respondents uses unprotected water sources 50% and 64.2% both in the rainy and dry seasons whilst protected sources 49.1% and 35.9% respectively. Irrigation water and pond are the second major source for housed domestic water use in the dry seasons and rainy seasons. Households` depend on ponds usually in the rainy and dry seasons even if it is an impermanent water source which is utilized by rural households. The highest respondents' percent values were consumed rain water and ponds whilst the lost unprotected hand dung well. Irrigation water supply mainly developed for purpose of cultivating vegetable and fruit which is invested by federal government. Both households` and production of vegetable and fruits used one water

source (irrigation water). Majority of households use this water source that is often too congested. Although, numerous households uses shallow and hand dung well were not congested as irrigation water.

The smallest alternative households` water source was unprotected hand dung well whilst rain water collection and pond were the largest in the rainy and dry seasons respectively. The highest households` alternative type of water was hand dung well whilst lowest deep well among improved water sources in the dry seasons. Deep well water supplies have been found in small number of kebeles. It challenges was far from households' houses to fetch water and return to back his/her house. Because of majority households uses rain water in the rainy season, the ` alternative water sources in the dry seasons greater than rainy seasons. From figure 1: implies that numerous households had no deep well water supplies. From key informative interview with district`s WMEO of water supply facility expert, he has said that this hitches arise from due to the fact that deep well were not invested by a budget of local government and that the existed was less repair and rehabilitation on regular manner.

The households depend on the water accessibility in the respective area. Due to different water availabilities in the bonde villages` shallow and hand dung well to be more alternative water whilst Balch Jimjima and Jewe villages` were pond and river. From an interviewed surveyed the household had one or more alternative water sources depending on the seasons. Water from pond and river are the most vital source in the both seasons where as rain water in the rainy seasons. Rain water stated as primary water source during rainy seasons.

4.3 Neatness of surrounding water sources and protecting it`s from contamination

By interviewing respondent's observation the clearness of surrounding and contamination of water sources in the district, the respondents were mentioned the environment around the source of water they utilized. They include both protected and unprotected water sources. The clearness of the surrounding areas of the water sources and its contamination was vigilantly interviewed because it may have an impact on the demand of water. Water source protection is that ensuring the quality and quantity of domestic water use. It was a general term for the protection of all water uses of the district.

Table. 1 Neatness of surrounding and protected water source form contamination

	Neatness of surrounding water sources	Frequency	Valid percent
Valid	Not clean at all	60	50
	Partially clean	31	25.8
	Clean	20	16.7
	Very clean	9	7.5
	Total	120	100
Valid	Protected water sources from contaminations		
	No, it is not	59	49.2
	Partially protected	40	33.3
	Well protected	21	17.5
	Total	120	100
	Responsibility to fetching water		
Valid	Adult male	21	17.5
	Adult female	38	31.7
	Male child(under 17 years)	15	12.5
	Female child(under 17 years)	46	38.3
	Total	120	100

Source: Household survey

Table.2 shows, about 50% of the respondents responded that surrounding water sources were not clean at all. The respondents described that the dusts, muddy and backwater were existed around water. Grass and algae is grown on water sources. Bad smell was caused by lack of eliminating mud, growing grasses and algae, animal waste and washing cloth around of surrounding. About 25.8% of respondents were partially clean around surrounding of water. The respondents pointed out that the water sources have fence, jailer, locked by key and have no backwater. Nearly 16.7 % of respondents were clean the surrounding areas. The respondents judged that for water pour has been done strike abyss. Thus, the muddy was not existed around water sources. For 7.5% of respondents were Very clean the surrounding areas. The respondents' views around water sources areas were constructed by asphalt that no bad smell and washing cloth.

Table.2 stated that the protected water sources from contaminations about 49.2%, 33.3% and 17.5% of respondents were no, it is not, partially protected and well protected respectively. About 49.2 percent of no, it is not respondents stated that animals and birds get on surface water were drink then urinate in it. Sources were contaminated by worm, insects and floods. Up to 33.3% of respondents demonstrate that sources did not contaminated by animals that have fence to lock by key. However, the water source could be contaminated by others. 17.5% of respondents were consumed well protected water source from contamination. The respondents' sated that water source was free from contamination.

Not clean at all were the highest percentage of respondents where as very clean is the lowest (table.2). This implies that the surrounding area of household water consumption is unclean. Clean and partially clean respondents responded that less than or equals to twice not, clean at all respondents. No, it is not were the largest percentage of household respondents where as well protected is the smallest (table.2). This shows that unprotected water from ponds, rivers, reservoirs that supplies for household which needs to protect this water. Not, clean at all and no, it is not had highest percentage values for neatness of surround and protected water source from contamination whilst very clean and well protected lowest respectively. In general, maintaining and preserving water source was poor in the district. The measurement has not been taken to protect water sources from contamination.

Primarily adult female and female child (under 17 years) had responsibility to fetch water for household members (table.2). For 17.5% and 31.7% of respondents were both adult male and female had responsibility to fetch water whilst about 12.5% and 38.3% male and female child (under 17 years) respectively. Often adult male and female who are called to the chore of water provision when water is fetched far from their dwelling house using a donkey. Though, both male and female are responsible for supplying water for domestic consumption, it was found to be that usually female were responsible for fetch water for their household members while male were responsible for watering the livestock's. In general, 38.3% female child (under 17 years) had highest percent values for responsibility to fetch water whilst 12.5% male child lowest respectively. This implies females had responsibility to fetch water than male.

4.4 Consumption of water

The issues were consumption of water by rural household and their demands in the rainy and dry seasons. Thus, to examine the quantities of water consumed in the rural households` whether to meet their water need of household members or not.

Balchi jimjima villages have no access protected water source for their household members. Therefore, mainly household domestic water use relies on the surface water. The entirely population of kebele were consumed unprotected sources. The communities were purchased drinking water from Awash town. Bonde villages have access to water supply. However, a few households` were used unprotected hand dung well. Though, Jewe villages used potable water supply, unprotected water source was the main domestic water use of communities. Due to only one deep well on spot was available for communities.

Figure 2: implies that household in Balchi Jimjima consume less water per capita than household in Bonde averaging 11.19 liters per capital per day in the rainy seasons and 13.71 liters per capita per day in the dry seasons as comparative to 17.18 liters per capital per day in the rainy seasons and 21 liters per capita per day in the dry seasons, respectively. Jewe kebele household, in average 12.63 liters per capita in the rainy seasons and 15.91 liters per capita per day in the dry seasons respectively. There was difference in quantity of water used in the three kebeles. Therefore, household consumption of water in Balchi jimjima and Jewe were lacked access to water supply relatively Bonde.

The average daily household domestic water consumption in the woreda is 99.75 Liters per day per household in the rainy seasons and 118 Liters per day per household in the dry seasons i.e. (about 14.25 and 16.86 Liters per capita/day per average household in the rainy and dry seasons, respectively).An average of 14.25 Liters per capital per day (l/c/d) per household is consumed in the rainy seasons compared 16.86 l/c/d per household in the dry seasons. A comparisons shows that water consumption during the dry seasons is not drastically greater than rainy season. The quantities of domestic water use is less than the WHO(1996) estimated minimum amount of 20 l/c/d of safe water needed for metabolic, hygienic and domestic purposes. Consumption of water in the SH is insufficient for household water use as compared to WHO estimated liters per capital per day. A possible reason for low consumption level was a small water supply

investment in the rural district. Thus, consequently water consumption is not equating to demand. Majority of household consumption of water was comes from traditional or unsafe sources.

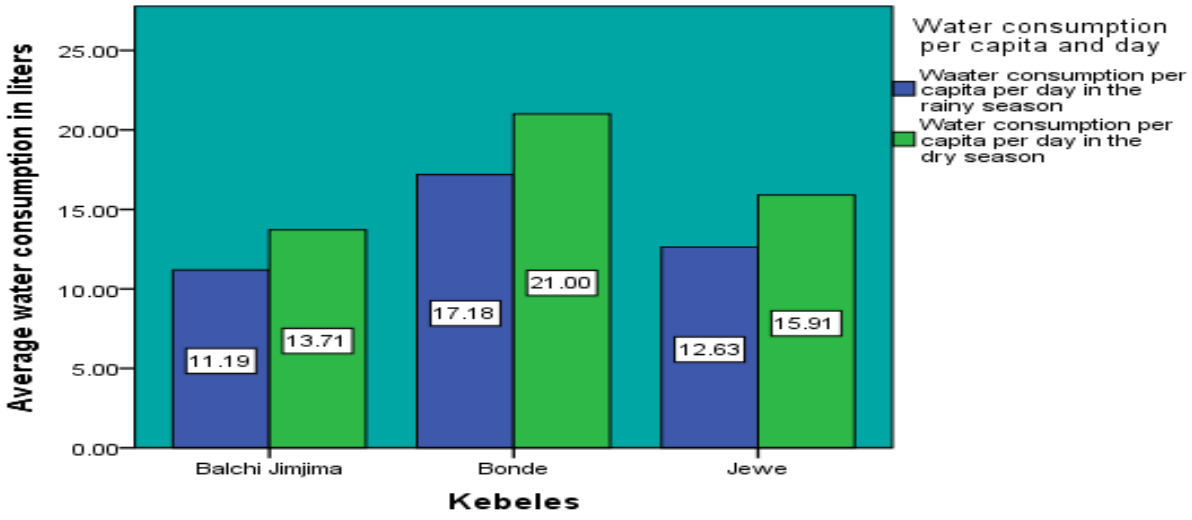
Table. 2 Average water consumption by kebeles and seasons

Kebeles	Water consumption in liters per day(Liters/day)	
	Rainy seasons	Dry seasons
Balchi Jimjima	3200	3920
Bonde	4810	5880
Jewe	3460	4360
Total	11970	14160

Source: Household Survey

The water consumption of household demonstrated that significant variation across the kebeles. The Bond kebele obtained the highest per capital per day water consumption in the rainy and dry seasons whilst Balchi Jimjima shows the lowest daily per capital per day water consumption. Although, Bonde kebele attain in the dry seasons the WHO estimated standard, households were consumed unprotected hand dung well. Generally, more water is consumed in the dry than in the rainy season.

Figure 2: Consumption of water per kebeles



Source: Household Survey

Figure 2: shows that the Bonde kebele households have stable water consumption those utilizing improved water supply as the accessibility of these sources usually does not vary by seasons. By contrast, the Balchi Jimjima kebele households depend on unimproved water sources that face water scarcity which affect household water use. Among Jewe kebele household`s partially rely on improved water source but more than half of households rely on unimproved source which is challenges for domestic water use of rural communities.

Consumption of water was varies at household level. The smallest water consumption liters per capita per year was a Balchi jimjima whilst the largest Bonde. Jewe household water consumption was more than Balchi jimjima less than Bonde which is remain between them. Annual consumption of water was 4689.15 liters per capita per year for Balchi jimjima household whilst 7185.5liters per capital per year for Bond and 5397.15 liters per capital per year for Jewe household respectively. The total amount of sampled household water use was 4894.65 M^3 per household per year. Thus, water availability in the district found to be a water scarcity.

4.4.1 Type of domestic water use

Table.4 stated that water use to drink, to do cooking, to keep personal hygiene, to wash home tools and house. Household members need a lot of water. Their water consumptions for drinking take between 12.09 and 18.68 per liters per day per household in the rainy and dry seasons respectively. Drinking water source which is unsafe water was made unpleasant household members to consume. Since rainy season a wet season that water need for drinking decrease due to weather condition that a cloudiness. By contrasts, drinking water increase during dry season. Much respondent's occupation is a farmer that they work hard during dry season such as harvesting and threshing. Due to this they need more drinking water in the dry season than in the rainy season. Additionally, dry season is a hot season that imposed household to drink more than rainy season.

For cooking water use is need about 7.86 and 8.49liers per day per household in the rainy and dry seasons to preparing food respectively. Up to 11.84 and 11.93 liters per day per household for personal hygiene to wash frequently face, leg and hand in the rainy and dry seasons respectively. For washing home tools and cleaning house is about 10.68, 11, and 6.48 ,

10.32 liters per day per household water was used in the rainy and dry seasons correspondingly. House washing water use was decreased in the rainy season because of the rural household home is mainly not made from cement. Washing cloth was the largest proportion which consumed a lot of water use. In average, it takes 50.79 and 57.58 liters of water per household for once cloth washing in the rainy and dry season respectively. Even if cloth washing was consumed more water, the households were washed cloth at water source.

The significance variance of water use was not found both in the rainy and dry seasons. Although, water scarcity existed in the dry seasons, the domestic water consumption was more than rainy season. That is to say, mainly water source of rural kebeles were limited to rainwater collection in the rainy season. Households were not interested to consume unprotected sources. Therefore, the households carefully saved and used rain water collection. Muddy and rainy were the cause that understated water consumption in the rainy seasons. In the dry season they were searched water use extensively from any sources in order to meet their demand.

Table.3 Average domestic water use by household and seasons

Water use	Water consumption per day(Liters/day) per household	
	Rainy seasons	Dry seasons
Drinking	12.09	18.68
Cooking	7.86	8.49
Personal hygiene	11.84	11.93
Home tools washing	10.68	11
Cloth washing	50.79	57.58
House cleaning	6.48	10.32
Total	99.75	118

Source: Household Survey

The variance in domestic water use for washing home tools, house and cloth were due to the fact that during rainy seasons household decided to use rain water that does not transport water for household members'. Water from all existed sources is used for drinking, cooking and personal hygiene purpose. Because Pond, rainwater, rivers, shallow and hand dung well and deep well were vital sources to households, they consume more from these sources (Table.1). Most

households use pond and river water for drinking. Note that the basis for the WHO standard has been questioned by Rosen and Vincent (1999). Gleick (1998) estimates 50 l/c/d as adequate: 25 l/c/d for drinking and sanitation and another 25 l/c/d for bathing and cooking. Accepting, Gleick's estimates as given, quantities of water delivered and used for households in the district was little which influence domestic water consumption.

In the dry seasons, drinking water consumption ranked as the second water per day per household used in respected to quantity of water that next to washing cloth(table.4). Domestic water use for cooking, personal hygiene and washing home tools in the both rainy and dry seasons were not significantly varies. Indeed the quantity of water used for them were different. Quantity of water consumption for cleaning house was understated in the rainy season than dry season due to muddy houses were not need large amount of water for washing. About 19.95 and 27.7 liters per day per household for drinking and cooking were used in the rainy and dry season respectively. For personal hygiene and washing home tools 22.52 and 22.93 liters per day household members were consumed respectively. Up to 57.27 liters and 67.9liters were used for once washing cloth and house in the rainy and dry season respectively. Consumption of water is generally considered to be insufficient that to meet the need for domestic water use.

Respective of the season households on a daily basis use more water in the rainy and dry season for drinking and personal hygiene than cooking and washing home tools per day per household. The quantities of water consumed per household was stated that a little and not significantly seasonal variation. The respondents stated that they need sufficient amount of water consumption to prepare meals and to have adequate for personal hygiene.

Table.5 shows, that the amount of water consumption by the sampled households in the rainy seasons, daily water consumption is 90 liters per day per households those consumed combined free and purchased water, 108.86 liters per day per households those used free water and 50 liters per day per households those consumed purchased water sources. In the dry season, water use rise to 118.6 liters per day per households those consumed combined free and purchased water and 126.77 liters per day per households those used free water and 80 liters for households those consumed purchased water. This stated that free water use was not granted for quality and quantity of water consumption found to be inadequate for household members. Although, households were interested in consumption of water from improved water source, up to 65.8 %

and 51.7 % of households free water use in the rainy and dry seasons respectively. Certainly, 6.67% and 12.5 of household users purchased water in the rainy and dry season whilst 27.5% and 38.83 % the combined free and purchased water in the rainy and dry season respectively.

A comparison of means indicated that water use during the rainy season is not significantly greater than dry season (t= -4.57) and it associated significance level (P<.000) which described that this is not the case that determining household water consumption. There is no huge variation in water use in the rainy and dry season

Table. 4 Water consumptions of households in liters per day per household

Household type	Responses	Rainy seasons		Responses	Dry seasons	
		Free water	Purchased water		Free water	Purchased water
Household using free and purchased water	33	70	20	43	78.6	40
Household using free water	79	108.86	0	62	126.77	0
Household using purchased water	8	0	50	15	0	80
All households	120	90.92	8.83	120	93.67	24.33

Source: Household survey

The households faced water scarcity during dry seasons special in the April and May season. Pond was dried up. The majority of household use pond as their main source of drinking water. So as pond used up, the household was faced a water scarcity. The other cause of water scarcity in the dry season is the result of limited reservoir storage as demand of water rise. Little amount of water was consumed for drinking, preparing meal and personal hygiene. Within little consumption hunger is augmented. Rises demand on restricted supplies, the efforts to water search daily were walked several kilometer. Once filled a jerry can which is weigh up to 40 and 50liters fetched water was carried by a donkey. The male and female were affected by the water

scarcity in the district. More time dedicated to obtaining water, both male and female have less time to chase their working activities that improve their economic situation.

4.5 Demand of domestic water

Domestic water demand includes the water required for drinking, cooking, personal hygiene, washing home tools, house and cloth. The per capital household demands were estimated using water demand data. It was assumed that past, present and future household water consumption could be realized through household knowledge and water demand decision. To examine water demand in the study area was based on the household interviewed survey. The study was started to investigate daily water demand from 120 households. The considerable decrease in quantities of water consumption was stated as investment in water supply has been low. This could be reducing household water consumption in greater liters. Thus, quantities of domestic water use would be fall due to low investment. Water demand predicts are normally considered the explanatory variables. Alternatively, the research was employed to estimate water demand via to determinants of water consumption.

Table. 5 Water demand and consumption in liters per day

Type of domestic water use	Water demand in liters per day	Water consumption in liters per day in the dry season	Water consumption in liters per day in the rainy season
Drinking	3370	2241	1451
Cooking	1660	1019	943
Personal hygiene	2880	1320	1421
Home tools wash	2470	1432	1282
Cloth wash	11520	6910	6095
House washing	3820	1238	778
Total	25720	14160	11970

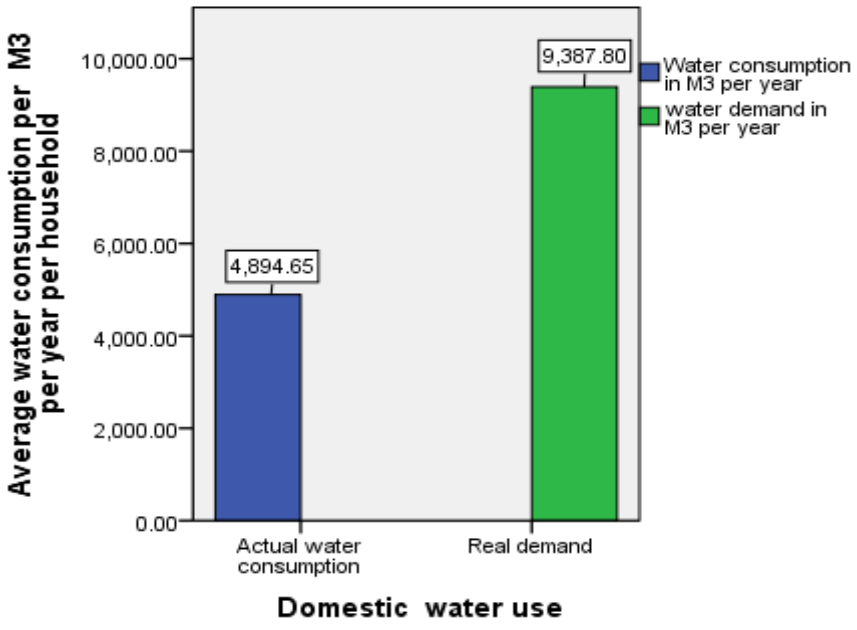
Source: Household survey

Table.6 implies that water demand found to be 25,720 liters per day per household whilst consumption was 11970 and14160 liters per day per household in the rainy and dry seasons respectively. Domestic water consumption is determined by explanatory variables. Mainly distance and time were influenced household water use. As distance increased water demand has

been reduced. Water demand and consumption for drinking, cooking, personal hygiene and washing home tools are 3370, 1660, 2880 and 2470 liters per day per household respectively. For once washing cloth and house are 11520 and 3420 liters per day per household. The water consumption and demand gap was about 13750 and 11,560 liters per day per household in the rainy and dry seasons respectively. Thus, variation of water demand and consumption was explained by 13,750 and 11,560 liters per day per household in the rainy and dry season's respectively.

In the principle water demand is equivalent to water use. The incremental of demand was not hitches water use of district. The hitches were low water supply investments. Water demand and consumption of cooking is the smallest whilst washing cloth was the largest. Washing house had the largest amount of water consumption and demand variation next to washing cloth whilst washing home tools had the smallest next to cooking. Drinking and personal hygiene had comparable water demand and consumption variation. In general, household water consumption was imbalance to demand.

Figure 3: Domestic water uses in M^3 per year



Source: Household Survey

Figure 3: stated that the amount of water consumption is small as compared to water demands in M^3 per year per household. The average household consumption and demand were 40.79 and

78.23 M^3 per year per household respectively. Annual water consumption was twice less than water demand. A sampled area water consumption and demand was varies from 4894.65 to 9387.8 M^3 per year per household respectively. Assuming, water supply investment increases, it was forecasted that between rainy and dry seasons, consumption of water in liters per capital per day in the district could be augmented by 82% (30.6 liter capita per day). Thus, the water demand for household consumption could be meet household demand by 82%.

4.6. Households` satisfaction

The study was examined different service satisfaction between the households`. The issues of households` satisfaction with regard to the service delivery of water supply system. Water supply situation and reliability were one of the area need to be examined using different indicators. Household of Bonde village`s are more satisfied about water sufficiency, reliability and quality whilst in contrast to Balchi Jimjima and Jawwe Village`s. Water service satisfaction is closely linked to water adequacy, reliability and quality. Satisfaction is the fulfillment and gratifications of the household water demand consumption. Category of satisfaction was analyzed by interview to households, the rate of water supply service satisfaction.

Table .6 Water supply services and reliabilities for rural households`

Satisfaction category	Responses				
	Frequency	Valid percent	Reliability	Frequency	Valid percent
Not satisfy at all	50	41.7	Not good	53	44.2
Partially satisfied	36	30	Good	32	26.7
Satisfied	21	17.5	Average	21	17.4
Very satisfied	13	10.8	Surpasses average	14	11.7
All household	120	100		120	100

Source: Household survey

Table.7 reveals that satisfaction category and reliability which vitally influence the water supply service. Up to 41.7 % of respondents responded that were not satisfied at all. The respondents stated that the primary water source for members of households was surface water. About 30% and 17.5 % respondents were partially satisfied and satisfied respectively. The respondents those consumed partially improved water source only for drinking and the remains their water use was unimproved sources. Satisfied respondents consume improved water sources than partially

satisfied. About 10.8% respondents describe very satisfied. This shows that respondents were received sufficient water quantities for their family members. Households were obtained adequate amount of water consumption per day. Accordingly,41.7% and 30 % of respondents responded that even if they were used unprotected water source, the quantities of water consumption for the household members are inadequate. The quantity of water was restricted for household water use.

The respondent results that the greatest percentage was partially satisfied next to not satisfy at all whilst satisfied the smallest next to very satisfied respectively(table.7). Percent of satisfied water service was less than partially satisfied. In general, not satisfied at all is four times than very satisfy whilst partially satisfied twice that of satisfied. This implies more than half of resident of district dissatisfied water supply services provided for their household members. The improved water sources were gave service 6hours per day. Although long hours for water supply service, households` were dissatisfied. The respondents stated that due to majority of households was consumed one water source that was overcrowded. The manual hand pump water supply was consumed long hours to fetch water.

Lack of water reliability results a water scarcity that had overwhelming effects on the domestic water consumption. About 44.2 % and 26.7 % of respondents indicated to not good and good that reliability of water supply service respectively. Respondents stated that interruption of water sources was existed. Water is used up, break down of spare parts and delaying to buying fuel for deep well were the cause for absence of reliability. Nearly 17.4 % and 11.7% respondents describe that average and surpass average correspondingly. This indicated less frequency of interruption of water supply service. The highest percentage value not good and good of water supply services implies lack of reliability which forced households to search drinking water from other sources.

The maximum household respondent percent of water reliability was not good and the minimum percent was surpassing average (table.7). The respondents described not satisfy at all by relating not good of water reliability. Due to ponds are dry up in the dry season, irrigation water was stopped service three times per week and water supply systems are breaking down by technical

error/broken facilities/. These have been forced households to decrease amount of water consumption. The respondent households with improved water source were generally happy with quality of water. With regarding to unprotected drinking water source, respondents were criticized quality of water that household's dissatisfaction, saying that water had bad taste.

4.7 Water sources related to water born disease

Households' opinion about water source described that unsafe water which is easily exposed them for water born disease. Table.8 stated that water service in which satisfies household members that protected from water born disease. About 23.3% and 35 % of respondents described that very unsatisfied and unsatisfied water services regarding to protect their family members from water born disease. The respondents mentioned that unprotected water source had not been free from contamination. Respondents those consume unsafe water were unsatisfied with their water consumption. 10.8 percents of respondents mentioned neither satisfied nor dissatisfied about water service to satisfy household that protecting disease. This shows that they were indicated the water supply service neither glad nor regret with regarding to satisfy household members. Nearly 19.2% and 11.7 % of satisfied and very satisfied respectively. Both Satisfied and very satisfied 30.9% of the respondents think that the water from the sources had not related with water born disease for their household members' of water consumption.

Table .7 Satisfaction of households from protecting water born disease

Satisfaction category	Responses	
	Frequency	Valid percent
Very unsatisfied	28	23.3
Unsatisfied	42	35
Neither nor	13	10.8
Satisfied	23	19.2
Very satisfied	14	11.7
All household	120	100

Source: Household Survey

In the healthy center, outpatient department expert explained that the contaminated water would be caused water born disease of giardiasis, typhoid and ameba. Annual reports of district health office ranked diarrhea and skin infection as the major top ten diseases. This implies that the

possibilities to being exposed for water born disease are quite clear for households` consume unsafe water. The results indicated that households` those consuming unprotected source significantly affected by water born since the source is simple contaminated. Thus, majority of households think that improved water sources provided quality of water. Due to this, large percent values of respondents those consume unprotected water source described very unsatisfied and unsatisfied of water supply services.

4.8. Access to water supply

The survey interviewed households whether they utilized improved water source or unimproved. WHO/UNICEF Joint Monitoring programe stated an improved drinking water source is one that by nature of construction and when properly used adequately protects the source from outside contamination, particularly faecal matter. Access to safe water is essential for human need. Water supply access were enabled an adequate quantities of water to be taken which is acceptable water quality. Thus, this part was examined household access to water supply.

Table.8 Access to water use for rural households

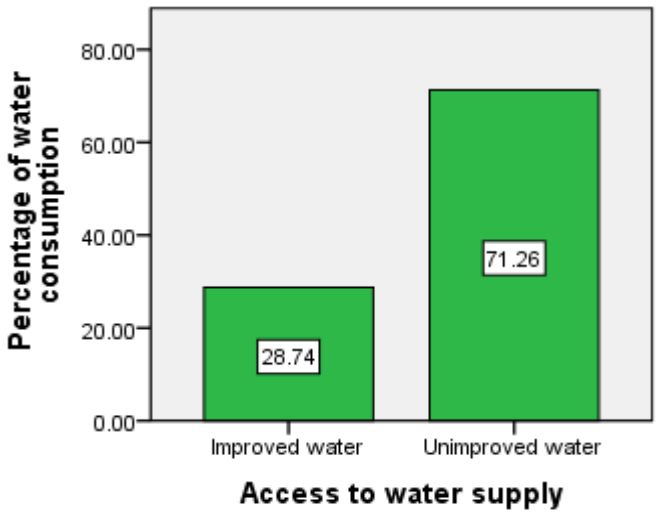
Type of water supply	Population using improved drinking water	Population using unimproved drinking water	The proportion of population access to drinking water
Deep well on spot	7875		5.71
Deep well with distribution	14200		10.29
Shallow well	7250		5.25
Hand dung well	6825		4.95
Spring with distribution	3500		2.54
Spring on spot		4900	3.55
Unimproved water sources(Pond, Irrigation water, traditional well and river)		93428	67.71
Total	39650	98328	137978

Source: WMEO, 2015

Table.9 stated that about 39,650 people were attained access to an improved drinking water source. Despite fact that an increase in drinking improved water source, the majority of population relying on unimproved water sources. Up to 98,328 people were directly drawn on surface water and spring on pot to meet their water demand. Among improved drinking water source the highest proportion of population were deep well with distribution whilst the lowest is spring with distribution. Now, about 28.74 % of proportion of population attained access to an improved drinking water source whilst 71. 26 % of populations were without access to safe drinking water.

Table .9 shows, more than half of population using an unimproved drinking water. The unimproved drinking water source was used by 71.26 percent of rural households'. Up to 5.71 and 10.29 percent of rural households were had access to drinking water from deep well on spot and with distribution. About 5.25 and 4.95 percent were had access to drinking water from shallow and hand dung well whilst 2.54 percent were had from spring with distribution . Deep well with distribution have a higher percentage share among improved drinking water source in the rural area. It was twice than shallow and hand dung well that households have access to drinking water. About 10.2 percent of households have access to shallow and hand dung well.

Figure 4: population using drinking water source



Source: WMEO, 2015

Figure 4: stated that about 39,650 of population had access to improved water sources (29 percent of district population). Up to 98,328 of population is without improved water source (71

percent of district population). Currently, improved water supply situation was poor where more than half of the residents have been consumed unprotected water .The result of sample survey implies that rural households had different drinking water supply sources. Although the rural households have been consumed safe water, the majorities relying on unprotected sources. In general, domestic consumption of water in the district is up to 98,328 people not having access to improved water source whilst 39,650 have. Water source is accessible for 24 hours a day for unprotected sources whilst between six and four hours are for improved water.

Dhika and Illamu were commonly consumed deep well with jewe kebele which is located in hindode village whilst Gejja kajjima, Migra, Gadamba and Jewe kebeles were consumed shared deep well which is cited in the boniya village. Due to this deep well water source was congested. Shallow and hand dung well not congested as deep well. This shows that, good for household water uses. Unimproved water sources also commonly used which was overcrowded. WHO (2005) recommended that at least one water point per 250 people for adequate water supply. Based on these categories, the sampled household those consumed Shallow and hand dung well had water accessibilities where as contrast to household those used deep well and unimproved source (irrigation water, Pond and river).

4.9 Time spent and distance travelled

Walk time and distance travelled to water source was derived from household interviewed and cross checked by key informative interview. The correlation between amount of water availability, walk time and distance travelled to source determined by lack of accessed to water source.

Table.9 Number of respondents with time spent

Responses		Frequency	Valid Percent
Valid	30minutes	25	20.8
	31-60minutes	51	42.5
	> 1 hours	44	36.7
	Total	120	100

Source: Household Survey

About 20.8 % of respondents of household spent time 30 minutes to reach and fetch drinking water. Up to 42.5 % and 36.7% of respondents spent time 31-60 minutes and >1hours respectively. The much walk time to water source of respondents found to be between 31-60 minutes whilst little 30 minutes. About 36.7% of respondents spent time more than 1 hour to obtain drinking water.

Table .10 Distance from household dwelling to water source

Responses		Frequency	Valid Percent
Valid	0-1Km	30	25.0
	1.001-2km	55	45.8
	>2KM	35	29.2
	Total	120	100.0

Source: Household survey

About 25% of respondents described that the water source from their dwelling house is located between 0-1kilometre whilst 45.8% and 29.2 % are with 1.001-2kilometre and >2kilometre distance travelled respectively. In general, about 20.8 % and 25% households have been less than or equal to 30 minute time spent and 1kilometre distance travelled whilst 36.7 % and 29.2 % greater than 1hours and 2kilometres respectively. Majority of respondents found to be distance travelled range between 1.001-1kilometres. The amount of water consumption of household for members in liters per day remain stable during fetching water that distance less or equal 1kilometre range. This implies that there could be variation large amount of water consumption and demand among households.

4.10 Water availabilities

Table .12 indicated that the quantity water obtained were too little that carrying out water use for drinking, cooking, personal hygiene, washing home tools, house and cloth. About 65% and 19.2% of respondents stated that poor and adequate quantity of water availability respectively. Lack of easy access to a water source may restrict the quantity of drinking water that is accessible to household. Although, the water is obtained from an unimproved source, when water demand to fetched from water source that is not immediately available to the household. About

10.8% and 5% of respondent was expressed that good and very good respectively. This implies easy access to water source that enable quantity of drinking water to accessible for household members.

Table. 11 Quantities of water availability

Water availability description	Responses	
	Frequency	Valid percent
poor	78	65
Adequate	23	19.2
Good	13	10.8
Very good	6	5
All households	120	100

Source: Household Survey

Generally, about 65% of household respondents were poor water availability whilst 5% very good. Respondents those received inadequate amount of water in liters per day described poor water availability whilst who obtained adequate amount mentioned very good respectively. The respondents up to 23 % and 13% were adequate and good water availabilities respectively. This indicates household obtained average amount of water in liters per day for their members of household.

The 65 percent implies that the rural population largely based on the unprotected water source contrast to protected water. Although protected water available in the district, surface water is the main source. Percent of 15.5 respondents implies that water use for rural household was usually protected water source. They obtained better amount of water consumption for family members. The woreda kebeles are different in water availabilities. The north-west parts of the district have an opportunity to develop in access of spring development whilst south- west parts an access to hand dung well. Although, the district was abundant in water source, their distributions across district were limited. In the absence of such water distribution, communities use the available water. Accordingly, data were obtained from WMEO, the district has high ground and surface water potential that estimated to be M^3 91 thousand and M^3 200 thousand respectively. This shows that the district is abundant in water resource.

4.11 Challenge countenanced in accessing to drinking water

Amount of drinking water supply found to be generally insufficient. This possibility to expose for challenges to majority of rural households in the district. Though, households need access to water within an average time of thirty four minutes the water availability was inadequate. The average minute spent in accessing drinking water was varies from kebele to kebele because of the accessibility of water sources. The study examined in the district that identified walk time to water source is a significant determinant of household water demand. The challenges countenanced by household in the district were travelling long distance.

The challenges were how rural households received improved water for the domestic consumption. The survey implies that numerous households consumed unsafe water. Thus, some households described unsatisfied domestic water use those consumed from unprotected water sources. Respondents stated that unsafe water has a probability to expose their family members to water born disease. The challenge to ensure the provision of water availability for households` in a sustainable manner was lack of financial and fully employed manpower. Providing improved water source for all kebeles(peasant association) at the same time requires huge financial outlay. In the absence of such water, households use unprotected water sources.

4.12 Descriptive statistics of explanatory variables

Table.13 shows, descriptive statistics of socio economic of households. The data used to analysis the decretive statistics from sampled household survey of 120 respondents were interviewed.

Table.12 Descriptive statistics of explanatory variables

Variables	Definition	Mean	Standard Deviation
Household size	Household size	7.01	1.91
Education	Number of household head education (1 if majority of household is an nonliterate,0 otherwise)	0.56	0.50
Occupation	Household head occupation (1 if majority of household head is farmer, 0 otherwise)	0.73	0.44
Time from source of water	Daily total time walking for fetching water(minutes)	33.97	6.75
Price per water jercan	Water price	0.28	0.29
Distance	Total distance(kilometer)	1.92	1.02

Source: Household Survey

The numbers of household members were different from 4 to 10 household members. In average household of the sample area had 7.01 family members. Up to 56 % of household head was not have years to spend in school suggesting most of household head that are non literate; they are unable to read and write whilst the reaming 44% is considered as literate. About 73.3% occupation of household head was farming whilst the remaining is trader, civil servant and others. The daily total time to fetch water that arrive from home to water source without including queue time, water from source has been taken in average 33.97 minutes. The average distance to drinking water source is 1.92 kilometer.

The average water price from improved water sources 0. 28 cents per 20 liters .The utmost and least water price in the sampled area found to be 1birr and 0.15 cents respectively. Prices are seen to different greatly between water sources and villages. Households those buy water from deep well and private were pay 0.60 cents and birr 1 per 20 liters respectively. Consumption of unimproved water sources is generally free. The households had access to one of free or purchased water source that relying on the less or equal to average distance of 1.92 kilometer.

4.13. Econometrics analyses

In this part the ultimate result of an econometrics analysis are presented on the logit estimation techniques. Such analysis assists to examine whether or not daily water consumption is determined by an explanatory variables.

4.14 Results of logit model

The logit regression was used to examine water consumption of households. The model consists of six independent variables (household size, education level, occupation of household head, water price, time for fetch water and distance). The model predictors was statistically significant at P< 0.05, with chi-square value of 17.676 (6, N=120), P<0.05, indicating that the model was able to predict respondents water demand. The pseudo- R2 equals to 0.441.

Among the variables time to fetch water and distance were found to be statistical significant that impact on likelihood of a household daily water demand. Household size, level of education, occupation of household head and water price were insignificant to determine daily water consumption of household members. Table .14 states that logit model estimation results for the water demand. The model is considering the statistically significant value that indicates significant at the 5% level.

Table. 13 Logit regression results for household water demand

Explanatory Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Size of household	0.122	0.108	1.273	1	0.259	1.130	0.914	1.397
Education	-0.304	0.428	0.504	1	0.478	0.738	0.319	1.707
Occupation	0.189	0.465	0.164	1	0.685	1.208	0.485	3.007
Time from source of water	-0.069	0.030	5.316	1	0.021	0.934	0.881	0.990
Water price	-0.361	0.721	0.251	1	0.616	0.697	0.170	2.862
Distance	-0.447	0.212	4.439	1	0.035	0.640	0.422	0.969
Constant	3.180	1.513	4.414	1	0.036	24.035		

Source: Household Survey

Variable(s) entered on step 1: Price in birr, Time in minute and distance in KM, Education level dummy non literate and occupation dummy farm household.

$$Y = \text{Bo} + \beta_1 x_1 - \beta_2 x_2 + \beta_3 x_3 - \beta_4 x_4 - \beta_5 x_5 - \beta_6 x_6 + \varepsilon$$

Where y= Water demand in liters per day

Bo = Constant/intercept

x_1 =Size of household

x_2 = Education level

x_3 = Occupation of household head

x_4 = Time for fetching water

x_5 = Water price

x_6 = Distance

ε= Error term

The size of household was found to be statistically insignificant at 5% that the sign of coefficient represents positive influence on household daily water consumption. The estimated parameters described that an increased household size by one unit, per capita daily water consumption have been increased by 0.122liters. Household size was positively influences daily water consumption. This states that the larger household, the more likely to need water consumption whilst smaller household, less likely to need water consumption. Households to increase their water consumption as their family size increase, but not by as much as an increase their family size that is daily water consumption increased.

As household size increase, say by one person, the estimated increases in the average the amount of daily water consumption to about 0.122 liters. The relationships between size of household and daily per capita water consumption were assumed that a positive relationships. As this result shows, the water consumption with respect to size of household is about 0.122 suggesting that of total household size added by one person, on average the water consumption on per capita goes up by 0.122 liters.

The odds ratio value for size of household is 0.886. This suggest that an increases in household size more likely to obtained 0.886 liters water of consumption than those size of household does not increases, other things remain constant. This is probably due to the fact that household those consume access to improved water source are better water supply utilities. Thus, water consumption on size of household is responsive to change in personal daily water consumption. The quantities of water consumption change per unit change in the size of households.

Although, education level was statistically insignificant, negatively influence the rural household in the case of demanded domestic water use from improved water source. The coefficient -0.304 estimated that as education level decrease household probability of the per capita water consumption from unprotected water source is increase. Education of the head of household has a negative sign of coefficient and insignificant relationships. This implies household members those non literate head have lower daily water consumption which obtaining from improved water source than did household with literate.

As non literate household head level of education increase, the knowledge of about the healthy benefit of domestic water consumption decreases. The amounts of water consumption by rural household members are negatively correlated to education level. Even if the amount of household water use is reduced by education level, more household members consume more water. The coefficient sign which is -0.304 for education level of household head, implies that domestic water use is decreases and household head challenge to critically to think about access to improved water source.

The education of household head has an odd ratio value 1.32. This means that one year spent in school increases education level of household head the odds in favor of literate household head that increase by 1.32 or about 13.2%. The literate household head have awareness to fetch water from improved source than non literate household, other things remain constant. Non literate household head is considered as equivalently significant both water quantity (how much water they consume) and water quality (how water is protected).Thus, amount of domestic water consumption decrease with respect to non literate household head increase.

Household head occupation variable is statistically insignificant and positively correlated to the amount of domestic water consumption. This implies that as occupation of household head

increase by one unit, amount of water consumption increases by 0.189 liters. The more household head occupied the enormous amount of per capita water consumption. Thus, household head launch to consume enormous amount of water per day.

Occupation of household head has an odd ration of 0.828. This implies that for a unit increases in amount of water consumption that the odds in favor of nonfarm household heads increases by 0.828 or about 82.8%. The probability of farmer household will be used unprotected water source is more than nonfarm households. The coefficient of household occupation head 0.189 described that the quantity of per capita water consumption for farm household head that consume from unprotected source is increased. Shows, that a positive relationship between occupation of household head and amount of water consumption.

Time to fetching water is statistically significant and negatively influences household water demand from the source of drinking water. This demonstrated that as the time for fetching water increases by one unit (walking time and waiting time) both free and purchased water sources, household per capita water consumption decreases by 0.069 liters. Coefficient sign of time for fetching water is estimated at -0.069 which implies that the household water demand significantly decreases with respect to time. This show that free and purchased water consumption would be considerably decreased due to the fact that an increase time required for fetching drinking water. The coefficient of -0.069 described other variable hold constant time for fetching water increases by one unit the amount of water consumption decreases by 0.069 liters. Suggesting, negative relationships between times for fetch water and amount of water consumption.

The odds ratio of time for fetching water was 1.07. This suggested increases in water fetching time more likely to decreases amount of water consumption by 1.07 liters, other variable hold constant. The probability of water demand decreases with one unit increases in time fetching for water is higher than coefficient value of 0.069. For additional minutes for water fetching the odds of time to fetching water is decreases water demand by 1.07 liters. As more and more of water demand, the opportunity cost of additional time has been increased.

The water price was found to be statistically insignificant and the sign of coefficient represents negative influence on household water demand. The coefficient of -0.36 described that other

variable hold constant ,water price increases by one unit per capita water consumption decreases by 0.36 liters. Suggesting, the quantity of water consumption and water price had a negative relationships. Water price was negatively correlated to water consumption for household those consume either purchased water or both combined free and purchased water.

The odds ratio of water price was 1.43. This stated that for additional unit in price the odds of water price decreases water demand by 1.43 liters. Household with purchased water 1.43 times more likely to decreases water consumption than those free water use. The probability of water demand decreases with one unit increases odds of water price higher than coefficient value of water price.

The water demand from purchased source is price inelastic among households. This shows, that household those consume free water source that prefer fetching water from purchased water source. The estimated logit model -0.36 described that households those consume purchased water or both combined free and purchased water are not responsive to change water price. The price inelasticity estimated -0.361 implies that water from varies sources consumed has no close substitute. Household those relying on both improved and unimproved water sources demanded stable amount of water consumption irrespective of change in price of water.

The distance was found to be statistically significant and the sign of coefficient represents negative influence on household water consumption. The coefficient of 0.447 demonstrated that other variable hold constant an increase of distance by one unit per capita daily water consumption was decreased by 0.447 liters. Suggesting, the correlation between quantities of water consumption and distance from household dwelling to drinking water source had a negative relationship. The correlation found between walking further to water source and smaller amount of water consumption. The longer distance results to time cost that influence household domestic water use.

The odds ratio of distance was 1.56. This implies that for additional unit in distance the odds of distance decreases water demand by 1.56 liters. Household those have access to water source 1.56 times more likely to increases water consumption than those has no accessibility of water. Probability of water consumption decreases with one unit increases odds of distance higher than coefficient value of distance.

4.15 Analyzing determinants of household domestic water use

Table.14 stated that the proportion of the variation in water consumption explained by explanatory variables. Distance and time were found to be the most statistically significant independent variables in the regression analysis as coefficient values are the third and the last for these six explanatory variables respectively. Both distance and time had a negative impact on water consumption as the sign of regression coefficient represents negative for time and distance. This demonstrated that as the value of distance and time increases water consumption would be decreases. Size of household and occupation of household head had positive impact on water consumption while education and water price had a negative impact as the sign of the regression coefficient found to be positive and negative represent respectively.

The categorical variable of education and occupation were statistically insignificant at 47.8% and 68.5 % respectively. Similarly, Size of household and water price was insignificant at 25.9% and 61.6%. Time and distance were statically significant at 2.1% and 3.5 % respectively. The highest percent values was a occupation of household head where as the lowest was time.

CHAPTER FIVE

SUMMARY, CONCLUSSION AND RECCOMMANDATION

5.1 Summary of finding

Majority of rural household water sources were surface water which is most threatening source compared to ground water. Unprotected water source was contaminated by animals, birds, worm, insects and uncontrolled flooding. Respondents claims protection of water quality is no, it is not about 49.2 percent. Maintaining and preserving of improved water is clean and protected whilst contrast to unimproved water source.

In the district, the sampled households' have the amount of water consumption in liters per day per household were 99.75liters and 118 liters in the rainy and dry seasons respectively. Household apparently has small volume of available water per capital. The average water use was 14.25 and 16.86 Liters per capita per day in the rainy and dry seasons respectively which is insufficient water consumption for resident of the district. Water supply service provision was not equivalent to water consumption. The respondents need access to sufficient water, they vied would be 30.69 liters per capita per day and quantity of water provided for the rural households` they could be affordable to purchase.

The amount of water consumption in the rainy seasons, daily water consumption is 90 liters per day per households those consumed combined free and purchased water, 108.86 liters per day per households those used free water and 50 liters per day per households those consumed purchased water sources. In the dry season, water use rise to 118.6 liters per day per households those consumed combined free and purchased water and 126.77 liters per day per households those used free water and 80 liters for households those consumed purchased water.

Water used in the liters per day per housed for drinking (12 and 17), cooking (8), personal hygiene (11) in the rainy and dry seasons respectively. Consumption of water was influenced by time fetching and distance travelled. The respondents that obtained adequate amount of water were about 28.33 percents. The challenges of insufficient water supply are hitches of low water supply investment.

As compared to literate household the higher non literate household the higher would be the likelihood to consuming unimproved water sources. Majority of households in the study area (64.2 percent) rely on unprotected water sources.

A comparisons shows access to water supply was deferent relatively significantly between rural kebeles (peasant association). Up to 39,650 district populations had access whilst 98,328 had no access to improved water supply. For many rural households` of working hour's decreases due to searching drinking water in the dry season huge time cost of walking and queuing

Distance and time had negatively influenced per capita water consumption as the sign of regression coefficient represents negative for time and distance. This demonstrated that as the value of distance and time increases water consumption would be decreases. Size of household and occupation of household head had positively influenced per capita water consumption while education and water price had negatively influenced as the sign of the regression coefficient found to be positive and negative represent respectively.

5.2 Conclusion

- The results demonstrated that alternative water source of rural households` are improved source (deep well, rain water collection, shallow and hand dung well) and unimproved source (unprotected hand dung well, irrigation water, pond and river). It was examined that numerous household uses unprotected water sources. This being the reason to maintaining and preserving water sources understated and household opinions of water consumption satisfaction related to water born disease was unsatisfied.
- Concerning the issue of improved water source, the households` have a greater interest to consume these sources. This is being the reason, 71.26% of population using unimproved water source in the dry seasons that the respondents would be used to have improved water source. Up to 28.74 % of households` had access to water supply compared to with just 71. 26 % of households` access is rigorously hindered by lack of water supply investments in the rural area.

- The Comparisons shows, that water consumption in the dry seasons is not significant variation in the rainy seasons. The amount of water consumption is less than the WHO estimated the minimum amount of 20 liters per capita per day of safe water needed for domestic purposes. Consumption of water in the district is insufficient for household water availability as compared to WHO estimated liters per capital per day.
- The water demand of sampled areas found to be 25,720 liters per day whilst actual consumption was 11970 and 14,160 liter per day in the rainy and dry seasons respectively. The water consumption and demand gap was about 13,750 and 11,560 liters per day per household in both seasons. Thus, water demand and consumption variation was explained in the sampled areas by 13,750 and 11,560 liters per day per household.
- According to the definition given by Bates et al., 2008 "access is defined as the availability of at least 20 liters of water per person per day from improved water sources within distance of 1 km". Accordingly, the finding majority of households are beyond meeting this standard. As indicated in the finding, 71.26% of the populations are without access to improved water source. They are questioning the sufficiency of improved water supply to fulfill their household requirements.
- Numerous households were dissatisfied water supply services. The household satisfaction has been revealed that 34 percent water supply service in terms of their water use. The respondents described that the primary water source obtained by members of households was surface water. This is a reason a high percent values of respondents were not satisfied at all was 41.7 percent whilst lowest satisfied 10.8 percent. Households` those are consuming unprotected source significantly affected by water born disease since the source is simple contaminated.
- The respondents responded that 65 percent of water availability was poor. This implies more than half of the residents have been consumed small amount of water in liters per day. This is being the reason, majority of respondents stated water availabilities were adequate 19.2 percent, good 10.8 percent and very good 5 percent.
- Reliability of water supply sources was not good. Due to ponds are dry up in the dry season, irrigation water was stopped service three times per week and water supply systems are breaking down by technical error/broken facilities/. These forced to household to search water consumption from other sources.

- The estimated explanatory variables are having a significant impact on household water consumption. A time and distance was statistically significant and inversely related to the source of drinking water. Thus, the longer the distance and time (walking and waiting) to a particular source of drinking water, the lower would be amount of water consumption in liter per day. This implies that high opportunity cost was for fetching water, particularly in the dry seasons. The dry season is the period of harvesting and threshing activities, which is need large amount of water consumption.
- Water price and education had statistically insignificant and inversely related to water consumption. Size of households and occupation of household head were statistically insignificant and positively related to water consumption. Studies have consistently shown that non literate educational attainment has a negative effect on water consumption. Water demand from purchased sources is price inelastic. This implies that households are irrespective of change in price of water and they are willing to pay for improved and reliable water supply. This can be described, now by challenge of water scarcity.
- Household water demand is derived from individual decision-making and personal responsibility. For rural households depend on free use and purchased of water sources needed to access to water use because water price, time collecting water, distance, education, household size, seasonal variation and etc that are factors influence household water demand. Such examinations, employing Logit Model for rural household water demand free use of water source and purchased water source.

5.3 Recommendation

Sebeta Hawas district is wide and consists of 41 rural kebeles, most of the time, a hitches of water supply is critically countenanced. Water availability was inadequate. The research has been examined access to water use for rural household members. Therefore, the following recommendations were suggested for research conducted:-

- The problems of rural households` water use were, after a few years water supply systems require repairs or rehabilitation. The absence of repairs and maintenance are problems for rural water supply availabilities. The households criticized that repairing and rehabilitation of water sources are very late when the information is suggested to woreda office. Therefore, water, mineral and energy office in the district has been considered the repairing and rehabilitation of water supply system to understate the scarcity of water.
- Though, the government has been invested on water supply development, water supply service was to take more time to offer service to benefit the resident of population. Therefore, monitoring and evaluation of water supply construction would be notably integrated in line with from water bureau to district water committee.
- There is need a community participation and mobilization focusing on alternative access to water source. North-West district communities have possibility to easily attain access to spring development whilst South-west hand dung well. So, strong community participation and mobilization considering improved water sources as key point to rural water supply development.
- Households use unprotected water without value addition. Thus, they have likelihood to expose for water source related to water-borne diseases. So, household members has been added value to properly treated boiling, adding chlorine and using water filter before use and to build fences direct contact with animals.
- Since negative relationships existed between education level and amount of water consumption the water, mineral and energy office has to initiate community awareness those still rely on unsafe water and orient the availability of water supply.
- Access to water service give benefit to averting of time cost that time saved. The time saved may be converted in to productivity gain and school attendance. Therefore, significant new water supply investments (deep well and protected well) have been

required not only in the Bach jimjima and Jewe kebeles but also particularly in poor access to water in the kebeles(peasant associations) more hours are dedicated in the dry seasons for fetching water from available sources.

- Giving attention to drinking water, the district administration and water, mineral, and energy office create better relationships with communities of residents, non-government organizations and government bodies that work to gather to develop improved water supply.
- Though, the government has been investing in water supply, more than half of population without improved drinking water. Therefore, populations without improved water source may be inspiring funding agency or government bodies would be participates for drinking water development.
- Strengthen the capacity of district water, mineral and energy offices by qualified and experienced man power, finance, and logistic facility are vital which need to be enhancement their implementation capacity and rises reliability of rural water supply. So, to increases households` water uses the district office has been employed and capacitated manpower.

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APPENDIX 1:

Questionnaire

Dear Sir/Madam

The above research is curried out as Masters Degree in population, Resource and Development in the department of Geography and Environmental Study, Addis Ababa University. I wish to have a little yak with you the water accessibility and supply situation in your district and how household water uses a variety of water source during rainy and dry seasons.

The truthful responds you have offer is the most vital factor that influencing the district domestic water use .Please, listen and answer the alternative that best describes your answer.

Part I: Household Characteristics

1. Kebele_____ ID _____

1.1 Name of Village_____

2. Size of household members

Male _____ Female _____Total _____

3. Age of the respondents_____

4. Who is household head?

0= male, 1= female

5. Level of Education:

1=Illiterate 2=Read and write

3= Elementary 4=Junior

5= High school 6=Techniques school collage

7= BA/BSC and above

6. Occupation:

1= Farmer 2=trader

3=civil servant 4=other

7. Monthly income of the household _____birr

Part II: Sources of water supply

What is the main alternative source of water supply for members of your household?

1= Shallow well 2= Hand dug well

3=spring development 4 = Deep well

5=public tap/standpipe 6= Rain water collection

7=Unprotected hand dug well / Shallow well / spring

8=Cart with small tank or drum

9 = Tanker track

10=Pond

11= River and Lake

12=Irrigation Channel

1.2 Referring your answers to the above question, who is providing main water source for you?

1= Government

2= CBO/NGO

3= Private

2. How do you describe the surrounding source of water supply in terms of cleanness?

1= Not clean at all

2= Partial clean

3= clean

4=Very clean

3. Is the source of water supply protected from contamination?

1= No, it is not

2= partially protected

3=Well protected

4. What measures has been taken to protect the water source from contamination?

_____

5. Who is responsible goes to source of water to fetch water for household use?

1= adult male

2= adult female

3= male child (under 17 years)

4=female child (under 17 years)

Part III: Quantity of domestic water use

1. Total quantity of water used in the rainy and dry seasons for your household members.

Seasons	Source of water	Actual water consumptions liters per capital per day
Rainy seasons		
Dry Seasons		
Total		

2. How much demand for domestic water use and its real consumption for your household members

1=Drinking: demand (liters per day) _____consumed (liters per day) _____

2=Cooking: demand (liters per day) _____consumed (liters per day) _____

3=Personal hygiene: demand (liters per day) _____consumed (liters per day) _____

4=House tools washing: demand (liters per day) _____consumed (liters per day) _____

5=Cloth Washing: demand (liters per day) _____consumed (liters per day) _____

6=House washing: demand (liters per day) _____consumed (liters per day) _____

3. How do you acquire access to water use in the rainy and dry seasons?

1=free use of water, rainy seasons

2= free use of water, dry seasons

3= Purchased water, rainy seasons

4=Purchased water, dry seasons

5=both free and purchased water, rainy and dry season

4. When did you last occur a water shortage for your members of household, what was the cause and what was the impact? _____

Part V: Satisfaction of water supply service

1. How did you see the water supply service to satisfy the needs of the residents?

1=Not satisfy at all

2=Partial satisfy

3 =Satisfy

4 =Very satisfy

If your answer is not satisfied at all, what service hitches have you observe in the water supply service?

_____

2. For how long the accessibility of water supply service in terms of delivery hours per day?

1=24 hours (private connections)

2 =6 hours

3=4 hours

4= 2hours

5=1hours or less

3. How did you rate the situation of the service of water supply your household utilizes?

Reliability

1=Not Good

2= Good

3= Average

4=surpasses average

4. How rate your satisfaction with regard to that your family members are protected from water born disease?

1 =very unsatisfied

2= unsatisfied

3= Neither Nor

4=Satisfied

5= very satisfied

5. Bestow your general view of water supply situation in your kebele?

1= adequate

2= inadequate

3= poor

Part VI: Access to improved water sources

1. How many households use a single water source? _____

2. What is the distance of the water source from your house? _____

3. How the quantity of water availability at least 20 liters per capital day with convenient distance from your home?

1=Poor 2 = adequate 3= Good 4= Very good

3.1 If your answer is poor, what type of water source do you need?

_____

4. Do you have adequate amount of safe water supply?

1=No 2=Yes

Part VII: Determinants of water demand

1. How much time it take to go to water source from your home, obtain water and come back?

1=30 minutes

2=31 to 60 minutes

3=61 to 180 minutes

4= more than 3 hours

5= does not know

2. If you fetch water from improved water source, how much do you pay currently per bucket (20 liters of jerry can). _____

3. If presently price of water twice, what do you assume to your water demand?

1= decrease, by how much_____

2=remain the same

3= increase, by how much_____

4. What if the price is diminishing by half?

1= decrease, by how much_____

2=remain the same

3= increase, by how much_____

5. What is the utmost price you have ability to pay for 1 bucket of water? _____cents

6. State the normal distance at which your water source is far from your dwelling. _____ Meter on normal.

8. What major challenges to ensure Safe and sufficient water supply for a household in the Sebeta Hawas district_____