Studies on the Role of WASH in Livelihood Security: Challenges and Opportunities the Case of Bora Woreda

A Thesis Submitted to School of Post Graduate Studies, India Gandhi National Open University in the Partial Fulfillment of the Requirements for the Degree of Masters in Rural Development

By

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Addis Ababa, Ethiopia

DECLARATION

I am hereby declare that the Dissertation entitled STUDIES ON THE ROLE OF WASH IN LIVELIHOOD SECURITY: CHALLENGES AND OPPORTUNITIES the case of Bora Woreda submitted by me for the fulfillment of M.A. in Rural Development to India Gandhi National Open University, (IGNOU) New Delhi is my own original work and has not been submitted earlier either to IGNOU or to any other institution for the fulfillment for any course of study. I also declare that no chapter of this manuscript in whole or part is lifted and incorporated in this report from any earlier work done by me or others.

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CERTFICATE

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Place: Addis Ababa, Ethiopia Signature

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CERTFICATION

This is to certify that Mr Bekele Abaire student of M.A. (RD) from India Gandhi National Open University, New Delhi was working under my supervision and guidance for his Project Work for the course MRDP-001 his Project Work entitled STUDIES ON THE ROLE OF WASH IN LIVELIHOOD SECURITY: CHALLENGES AND OPPORTUNITIES the case of Bora Woreda which he submitting, is his genuine and original work.

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Finally, none of this would have been possible if not for my wife, AyshaKedir and my three daughters, Lense, Gift and Faya, thank you.

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ACRONYMS

CRS/Et = Catholic Relief Services Ethiopia program

ECCSDCOM = Ethiopian Catholic Church Social and Development Coordinating office of Meki

BoFED = Bureau of Finance and Economic Development

DFID = Department for International Development

ECA= Economic Commission for Africa

IDR= Institute of Development Research

IGNOU = India Gandhi National Open University

IRC = International water supply and sanitation

m.a.s.l= meters above sea level

MWA-CNHF = Million Water Alliance- Conrad Hilton Foundation

MoWR = Ministry of water Resources and Energy

MoFED = Ministry of Finance and Economic Development

NGOs = Non-governmental Organizations

OWRB = Oromia Water Resources Bureau

PAs = Peasant Associations

PASDEP= Plan for Accelerated Sustainable Development to Eradicate Poverty

RWSS = Rural water supplies and Sanitation

UN = United Nations

UNECA = United Nation Economic Commission for Africa

UNDP = United Nation Development program

UNICEF= United Nations Children and Education Fund

WASH = Water Supply, Sanitation and Hygiene

WB = World Bank

WSS= Water Supply and Sanitation

WHO = World Health Organization

ABSTRACT

This study was conducted with a general purpose of assessing the role of water, sanitation and hygiene in livelihood security of communities with emphasis on the challenges and opportunities at Bora woreda in East Shewa zone of Oromia region. Alemtenais the capital town and is located 110 kilometers south of Addis Ababa along the main asphalt road to Awasa city.

Both primary and secondary sources were used for the study. Focus Group Discussion, household surveys, observation method and key-informants interview were the instruments to collect data. Household survey was conducted in three selected kebele administrations and 100 heads of household representatives (43% women and 57% men) were interviewed. Three focus group discussions were held with water committee members, elders, health Extension workers, development agents and kebele administration officials.

About 35.8% of the respondents asserted that there were some changes in the livelihoods ((increased income 21.6% and increased productivity of livestock 14.2%) following provision of water supply interventions. Similarly, about 57.4% of the respondents' asserted that the health of family members have been significantly improved after they had began to use improved water supply system. The findings from the discussion with FGD and key informants and personal observation were in agreement with household survey results. Furthermore, the finding from discussion with FGD, key informants, document review and observation spelled out that high fluoride in groundwater is the major concern and requires further consideration.

The study had indicated that improved water and sanitation had significant impact on the well being of the people and also the management of water supply system through involvement of community during planning, implementation and monitoring.

The impact could include significant improvements in household income level and security of livelihoods. Increased school attendance of children with better child care, social and cultural benefits such as reductions in stress levels, increased status and self-esteem, better family and community relations, and increased ability to observe religious rites and customs.

Involving community members in planning, monitoring and management of the projects brought new insights into long term sustainability of water supply and sanitation systems. Understanding the potential that water supply and sanitation projects can have on poor people's lives underlines the fact that access to safe water and sanitation is a precursor to any form of sustainable development

The study hasidentified areas that need further intervention and research, including institutional capacity building, maintenance and operation, strengthening of community involvement, selection of appropriate technology, water quality and rainwater harvesting

CHAPTER- I

1. INTRODUCTION

1.1. Background

Access to safe water is among the top priorities in almost every region in Ethiopia. Only 42% of rural households have access to potable water, and fewer than 27% have access to improved sanitation facilities (Baseline Survey for National Nutrition Program, Ethiopia, 2009/2010). Given that 85% of Ethiopia's population lives in the rural areas, these low access rates contribute to high water-borne and fecal-borne disease incidence throughout the country. In fact, diarrhea is the second leading cause of mortality and morbidity in children under five in Ethiopia, after acute upper respiratory infection. Poor hygiene is also responsible for a myriad of other health problems including skin and eye Ethiopia (Demographic and Health Survey (DHS, 2005).

Though endowed with natural resources, Ethiopia remains a low-income, food-deficient country. The United Nations Development Programmed (UNDP) 2003 Human Development Index lists some salient facts about the country: Ethiopia ranks 169 of 175 countries.

- 82% of the population lives on less than $1/day.
- Life expectancy is about 46 years for men and women.
- Infant mortality is 77 per 1,000 live births.
- Under-five mortality is 123 per 1,000.
- Adult literacy rate is at just 40%.
- Only 42% of rural households have access to safe water.

The causes for these low access rates to potable water and sanitation facilities include lack of awareness, complex hydro-geological conditions, lack of resources and a conducive environment to develop the appropriate infrastructure, and environmental degradation. The effects, once again,

are mostly felt by children, whose development is retarded by diarrheal diseases, and women, who must spend many hours every day collecting water from distant water points, taking time away from caring for their children or engaging in productive activities. Distant water sources and reliance on rainfall often force entire communities to migrate in times of drought or low rainfall.

Even though efforts have been made by the government and non-governmental organizations to improve rural water quantity and quality by drilling deep boreholes and constructing water filtration plants, the changes have been minimal. Communities are not able to maintain these expensive infrastructures when there are breakdowns.

The mapping of water resources in Bora woreda - showed that the community had access to river water, pond and lake within the area. From visual observation, most of these sources were found unsuitable for human consumption as livestock have open access to all the sources at any point in time and all along their course with the exception of deep boreholes constructed government and Non-Government Organization (NGOs), like Catholic Relief Services, Ethiopia Program (CRS/Ethiopia).

The combination of poverty, environmental problems, and stress related to social instability and insecurity are associated with a number of health conditions in the area. In particular, the high frequency of malaria, tuberculosis and HIV/AIDS appear at increasing rate in the area.

The immediate causes of child morbidity and mortality include malnutrition, diarrhea and malaria. Percentage of under-five children suffering from moderate and severe underweight is 47%. Wasting and stunting rates are 13% and 38% respectively. It is estimated that over 80% of health problems are due to communicable disease and nutritional problems (Baseline Survey for National Nutrition Program, Ethiopia, 2009/2010).

Currently, access to potable water and sanitation is 48% and17% respectively, in rural areas of Bora woreda. The access for both water and sanitation does not comply with either national or international guideline.Thereare over 21motorized deepboreholesand 16 shallow borehole equipped with hand pumps, while almost all have high fluoride content. People use simple pits in general which are not qualified as improved toilets (JMP report 2010).

In order to ensure sustainability of any water source developed, community capacity building and backstopping has been found very important as recognized by all stakeholders. Therefore, capacity building of community in building knowledge and supply of tools has been accepted as major linkage to water source development. Since collecting water is the major duty of women and children capacity building will be emphasized on these groups.

In most areas ground water is the only existing potential for drinking water. In the area, ground water is often of poor quality with high fluoride and salt level that affect human health. Ethiopian Catholic Church Social and Development Coordinating office of Meki (ECCSDCOM) in collaboration with CRS/Ethiopia is involved in reducing the fluoride content by using a new approach of community-based de-fluoridation techniques. Aluminum Sulfate and lime were used to reduce fluoride content of ground water to safe level. Treatments were applied at community level by representatives' of the community. This approach ofreducingfluoride content at community level has been accepted by all stakeholders including the local government and the community. Any groundwater development activities will include deflouridation system.

Despite these problems, the project areas have potentials and options to improve the livelihood of targeted communities. In the Woreda, land holding size per HH is relatively bigger, i.e., 2 ha; water is available for irrigation and farmers have better access to markets. There are opportunities

for diversifying and intensifying the farming systems and assist the targeted groups in promoting market led agriculture. The target area has good potential for irrigation, as water is available from Ellen, Koka lakes and Awash river(TeshomeErdaw, MA thesis on Challenges, Opportunities and Experience of Small Scale Irrigation, A Comparative Study of Dugda Bora woreda of Oromia and Enderta Woreda of Tigray regions, June,2009).

- The need to include more participatory approaches which support HHs and communities in a

Process of attitudinal change as well as providing knowledge;

- The need to build stronger links between the community and the formal health structure

Including the local health facility;

- The importance of longer-term low level support to the community management committees

And volunteer health and water and sanitation workers, as part of a slower phase out strategy.

- The importance of ensuring promoted behavioural change such as latrine use is accessible for

the community.

1.2. Statement of the problem

Huge amount of resources in terms of human power, material supplies and financial expenditures have been invested by the government, bilateral and multilateral agencies and NGOs at local and regional levels for the construction and provision of improved rural water supply services in developing countries. It is unfortunate that the efforts, objectives and goals could not fulfill and be sustained as planned. Lack of achievement of objectives in water supply and sanitation services

have adverse impacts on the livelihood of the user community. Whereas properly managed improved water supply and sanitation service has positive impacts on the productive capacity, health and welfare of the society (WHO, 1990a as cited in Burqitu, 2002).

For instance, in developing countries, not only are investment levels low, but even meeting recurrent costs for operation and maintenance have proven to be a major problem. Unacceptably high level of investment continues to be wasted as many systems fail to non-functional level almost as quickly as they are built. Some evidences suggest that 30-40% of the water supply schemes in developing countries may be broken down at any time.

Therefore, the provision of water supply and sanitation near to home or school enable us to enhance the impacts of water supply on the livelihood. When water supply improvements are coupled with opportunity to create income through microenterprise, time released from water collection is converted into income earned. This brings several benefits:-reduce drudgery, higher household income and consequently greater women's empowerment through changing gender relations within the household. An improvement of water supply to the extent that women spend one hour per day on collecting water would result in an improvement of the annual income...Alternatively, each woman might gain between 45 and 152 eight hour days annually for domestic, social and development activities (Teshome, 2006).

The unavailability and inaccessibility of potable water service greatly contributes to poor health and low productivity. The Central Statistics Authority Report of 2004explains lack of safe water as the major causes of water borne diseases and death in most developing countries including Ethiopia. Apart from causing poor health and death, Meseret (2006), indicates the negative

consequences of unavailability of safe water on society as “lack of safe water supply has other chain of negative consequences such as the work load on women and children in fetching water mostly from very distant areas’’.

Water is a valuable natural resource fundamental for life and it is believed that facilitates the overall socio-economic development of a nation. Women spend much of their time in fetching water even from long distances. So provision of adequate and clean water helps to free up the labor of women and children who are used to collect water to other production activity (MoFED, 2002).

The management system of rural water supply can enhance or reduce the targeted impacts of rural water supply on the livelihood of the user community. For instance, the Oromia Rural Water Supply Schemes inventory data of 2003 indicates, of the existing 477schemes ((15 springs 165 diesel driven, 46 wind mill, 3 solar energy driven deep boreholes and 248 hand dug wells equipped with hand pumps) 13% are not functional in the Eastern Showa zone of Oromia region (BachaNigussie, Head, Water Supply Management Facility Process, East Shoa Zone WRO, 2010). This non functionality is only in terms of failure in engineering. Failure related to water quality problem, conflict, poor management and other related not considered.

The functionality of water supply system for this paper considers the reliability and suitability of the developed water sources in addition to physical (engineering functionality). The water source for Bora woreda where the three target kebeles for this research located is from deep boreholes, AwashRiver and Koka dam. All the water from the bore has fluoride content higher than 4 liter

per second. In the woredathereare21 deep boreholes and out of these 29%was non-functional in the same year reported for the zone considering only the physical functionality.

This indicates that higher percentage of non-functional schemes inBoraworeda implies the reduction of the targeted impacts of improved water supply on the livelihood of the user community as a result of poor management systems of water supply schemes. In addition to this, there are very few empirical studies on impacts of rural water supply and management systems on the livelihood the rural community at Regional level and no study has systematically addressed the issue in study area.

As indicated water quality is also the major problem in the target woreda. The major water quality problem is high fluoride in water. Bora woreda is located in the Central Ethiopia Rift Valley where fluoride concentration is high both in groundwater and surface water (mainly lakes water). Excessive and undesirable levels of fluoride in drinking water supplies are common problems in the Rift Valley of Ethiopia. The maximum amount of fluoride in drinking water is regulated at 1.5 mg/l (WHO, 1970). The 1984 WHO guidelines suggest the permissible fluoride level to be 1.0 mg/l in warm climate and 1.2 mg/l in cooler areas. Prevalence of dental and skeletal fluorosis has been well documented in Ethiopia where fluoride concentration in drinking water exceeded the guideline level (Haimanot et al., 1987).

1.3. Objective of the study

General objective

The main objective of the study is to assess the role of water, sanitation and hygiene on the livelihood of the user communities in Bora woreda.

Specific objectives

In relation to this, the study will have the following specific objectives:-

- To explore the existing water supply schemes in the study area;
- To assess the technical, social and institutional factors that hinder the impacts of rural water supply, sanitation and hygiene in the study area;
- To assess the impacts of rural water supply, sanitation and hygiene on the livelihood of the user communities in the study area;
- To assess factors hindered communities from using innovative technologies mainly Defluoridationand Ecological sanitation;
- To assess the quantity of water used by households in relation to proximity of water sources and its socio-economic and health impacts;

1.4. Research questions

In order to address the above issues, the study will attempt to answer the following four research questions:

1. What are the types and status of rural water supply schemes in the study area?
2. What are the technical, social and institutional factors that hinder the impacts of rural water supply, sanitation and hygiene on the livelihood of the user community in the study area?

3. What are the impacts of rural water supply, sanitation and hygiene on the livelihood of the user communities in the study area?

4. What are the factors that hinder communities from using innovated technologies?

1.5. Significance of the study

The study is believed to be important since it is expected to identify the impacts of Rural water supply, sanitation and hygiene on the livelihood of the user communities In the study area. Thus, it is hoped that the findings of this study will help:

- To provide specific data for further studies and revision with a view to making the rural water supply scheme, sanitation facilities, hygienic practices more effective and efficient;
- To provide specific data on impact of water, sanitation and hygiene on the livelihood of the user communities in the study area;

1.6. Scope of the study

The study will focus on the role of water, sanitation and hygiene on the livelihood of the user community in Bora woreda. The reasons for selecting Bora woreda as a study area were due to:-

- The fact that water supply, sanitation and hygiene are the privileged field for the study and the intensity of the problem and the specific situation in the area has driven the attention of the researcher to select the study area. Accessibility was also another factor for the selection of the study area;
- Bora woreda is one of the CRS area where development work is on going.CRS is supporting integrated program where water, sanitation and hygiene is the main component;

- Moreover, no study has systematically undertaken that address the role of water, sanitation and hygiene on the livelihood of the user community issue;
- The study will consider baseline data by government and NGOs like CRS;
- The study will assess the amount of water carrying time "saved' as well as the effects of these savings on engagement in new activities. Therefore, further research for better understanding will have great importance;

1.7.Definitions of Terms

Terms that carried a unique meaning for the purpose of this study are defined as follows:

Sustainability: In context of drinking water supply schemes, sustainability refers to the ability to maintain efforts and derived benefits both at community and agency level even after the assistance (managerial, financial and technical) is withdrawn (WECD, 1987).

Livelihood comprises the capabilities, assets and activities required for a means of living (Chamber and Conway, 1992).The dictionary meaning of livelihood is the money people need to pay for food, a place to live, clothing (Cambridge university press, 2003).This definition emphasizes only the income that an individual gets and pays for different necessities.

Impact: The changes produced. It is an expression of the results actually produced usually at the level of broader, long range objectives. Impact measures the final results (Issayas and Tadesse, 1988:5).

Community management: community management of water supply and sanitation start from project identification and goes deep in to contribution in cash and kind and monitoring during implementation and managing the scheme(Ksami and EC Murray,1998).

Better health: it has been widely established and accepted that more and better quality water, and improved hygiene, reduces disease. Healthy people are able to work and live more productive lives (Ksami and EC Murray, 1998).

Time savings: time and effort spent collecting water can be reduced by improved water Supplies. Especially for women and children who shoulder the burden of water collection (Ksami and EC Murray, 1998).

Expenditure savings: improved water supplies lead to reduced expenditure on drugs to Treatillness (WHO, 2007).

Well-being: better water supplies reduce pressure on people, especially women. As well as time saved, there is less stress, anxiety, and improved safety when water supplies are available close to home

Empowerment: ensuring that the powerless are given a voice and increasing their capacity to participate in community decision-making can help empower marginalized women, the poor and other groups (Ksami and EC Murray, 1998).

Community capacity: well designed, planned and implemented water projects can strengthen and extend the capacity of local organizations in areas like decision-making, financial management, and ability to carry out operation and maintenance.

Productivity and income: more opportunities for home-based activities lead to improved employment, productivity and incomes. Non-water based livelihood activities are possible because of time savings, better health, and opportunities to invest expenditure savings (Ksami and EC Murray, 1998).

Operation: It deals with the actual running of a service (e.g. Provision of fuel, starting or handling of pumps, control of water collection points, general mechanical)(Ksami and EC Murray,1998).

Maintenance: It deals with the activities that keeps the system in proper working Condition, including management, cost recovery, repairs and preventive maintenance (Ksami and EC Murray, 1998).

CHAPTER II

2. LITERATURE REVIEW

2.1. Concept and Definitions

Rural Water Supply

According to WHO (1982), the term rural water supply covers all the measures taken to

Satisfy the demand for water in predominantly rural regions. For water supply purposes, a community with a population less than 10, 000 is identified as rural. Rural water schemes are also defined as points improved by the joint efforts of users and government or NGOs. Rural water supply and sanitation schemes share some common characteristics. They require low capital costs, mostly use locally available materials, largely based on similar design relied on the approach and technology understandable to the people who are using it, local labor, controlled and maintained by villagers who are flexible to be used or adapted to fit to changing circumstances. The expected outputs of these water schemes are improvements in health, income, institutional strengthening and technological know-how, as well as environmental resilience (Magnesia, 2002:12).

Rural water supply and scheme management

Community management in rural areas is at least, the driving paradigm for the water, sanitation and hygiene sector. Community management is all about putting communities in charge of developing systems that respond to their needs. Water for productive uses is high on this list– frequently even higher than is treated water for domestic use. On the downside, not taking likely productive use into account can lead to system under-design and, in turn, to failure. Livelihood approaches, which emphasizes the capabilities as well as the needs of people and take into consideration the complex nature of communities and intra-community relationships, can help optimize the community involvement in system design and implementation. Similarly to community management (with which they are frequently linked), demand responsive approaches are all about matching systems to people with the primary goal of achieving sustainability. Productive uses of water have a crucial role to play in turning water into the cash with which to buy spare parts and pay for routine maintenance. Clearly establishing the link between water supply and economic benefits also seems to increase people's willingness to pay for their water in the first place (IRC, 2003, cited by Lechissa, 2008).

Community management of the rural water supply services is considered as one of the options for achieving sustainability of the water services. Less demand for reconstruction or rehabilitation of broken down systems means more satisfying and more productive work on new schemes. Similarly, studies in Tanzania and Thailand suggested that the water supply systems which provided the most reliable services were those where communities not only contributed to the operation and maintenance of the schemes, but met them in full (Darken, 1989a, 1980b).

Problems at the planning and appraisal stages create loop holes for the emergence of problems that can be a threat to sustaining services. Giving proper attention to software aspects of the project at planning stage therefore helps to develop a sense of community ownership to enhance users' involvement in project management and consequently contributes to sustainability of benefits. Developing sense of ownership will enhance the impacts of rural water supply on the livelihood of the user community (Ausguide, 2002:3, cited by Mengesha, 2002:14).

Building the capacity of grass-root actors that have stakes in water source and water point management, both during project implementation and even after projects are handed over to the user communities, is a viable way of alleviating managerial and technical capacity constraints in rural water supply context, it refers to providing various trainings to elected water supply and sanitation committees, local caretakers and community at large so as to enhance their capacities that can be applied in managing improved water supplies. In addition, it also refers to providing various technical assistance/backup services, equipping water supply and sanitation committees and village technicians with essential practices and experiences, and providing maintenance equipment that can be used in managing improved water points (Getachew, 2002).

Impacts of improved water supply

Domestic water supplies can be productive and productivity can contribute to peoples' livelihoods, particularly those of women and the poor, thus increasing the impact on livelihood. Until recently, the multiple benefits of domestic water supplies had not received as much attention as they deserved. The traditional view of domestic water as largely a 'public health' benefit persisted even beyond the 1980s when international agencies continued to focus on 'clean

drinking water and adequate sanitation' as a key right and development goal (IRC,2003 cited by Lechissa,2008).

Rural water supply and sanitation have the potential to act as a catalyst for change in the socio-economic and health aspects of the target communities. Several impacts are anticipated from the developed improved water supplies. One of the social conditions that could primarily be improved by the provision of water supplies is a reduction in the effort and time required to collect water. Improving physical access to a physically dangerous source can be a major benefit in itself. The locations of some water points are risky and dangerous to women and children. Carrying the heavy load of water, either on the head or back, from far distant locations or sources causes various health hazards. They suffer headaches and exhaustions due to heavy weight of carrying water. For low-income women, the working day is excessively long. In many African countries, including Ethiopia, the collection and carrying of water and fuel wood over considerable distances can result in women having only few hours' sleep a night in the dry season (Alemu, 2006).

The lack of access to water supply has impacts not only on the quality of life of the poor, but also productivity and health. According to a survey carried out in 2001 by the Salvadoran think tank, the rural poor in particular spend a significant share of their productive time collecting water. Families without house hold access to water spent 4.9% of their productive time for fetching water. For the structural poor the values were much higher with 13.6% and 7.1% respectively (El Salvador-Wikipedia, the free encyclopedia, eb, 2008). The livelihood of the people is also greatly influenced by the accessibility of water and sanitation which is necessary in the improvement of their economic wellbeing.

A person has to drink certain quantity of water per day to remain hydrated and healthy. Along with this water is essential for cooking, promoting personal hygiene. The people's livelihood can

be improved through provision of safe water supply and appropriate sanitation which can minimize the large amount of time and energy spent in fetching water. The time and energy saved through provision of improved water supply and sanitation can use in many economically productive activities (DFID, 2001:25, cited by Tefera, 2007). Improved water supply is important for maintaining the health of individuals. Having access to safe water for drinking and food preparation highly influence the health of people. By having washed the cloths, hands and other parts of the body one can keep him/her healthier. Without adequate and wholesome water supply, health cannot maintain. Access to sanitation is the critical determinant of preventing drinking water from being contaminated. Good health is both an end and a means of sustainable livelihood. For poor people good health is an essential asset in the pursuit of their livelihood, their home and work environment often threatens their health. Improved water supplies can also reduce time and effort spent to collect water especially for women and children who shoulder the burden of water collection. Improved water supplies also lead to reduced expenditure on the generally expensive water provided by water vendors, and less money is spent on drugs to treat illness. Moreover, well designed, planned and implemented water projects can strengthen and extend the capacity of local organizations in areas like decision making, financial management, and ability to carry out operation and maintenance. Non-water based livelihood activities are possible because of time savings, better health, and opportunities to invest expenditure savings. Improved incomes lead to improved status: for example, of women when their economic contribution to the household is visibly improved (IRC, 2003).

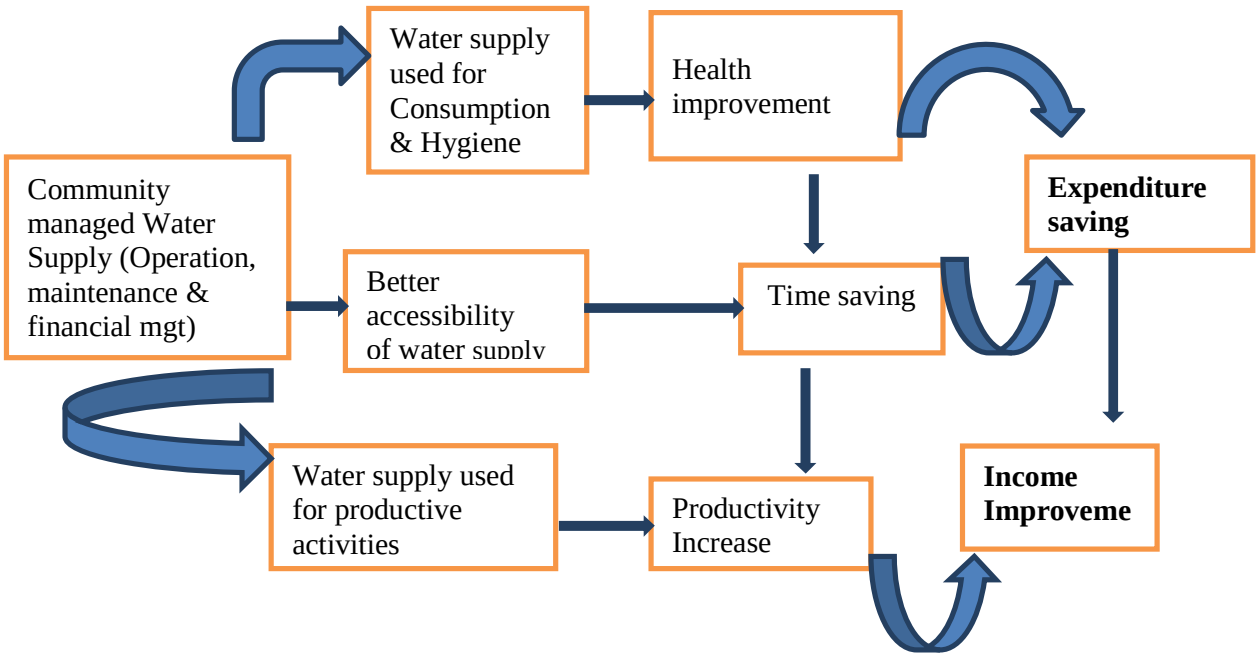

Figure 1: Conceptual framework (Adopted from IRC, 2003)

As shown in fig.1 above, IRC (2003) came up with this conceptual framework to study the impacts of rural water supply on the livelihood of the user community. In this frame work, well managed and adequate water supply will be resulted in health improvement and time saving. Improvement in health of family members and time saving will be resulted in expenditure saving and income improvement. The implication is that properly managed rural water supply has positive impacts on the livelihood of the user community.

2.2. Experience in Rural Water Supply Management

Rural water scheme management in Oromia

There are three rural water supply management options, which are currently operational. These include water committee, water board and indigenous water source management

Water committees are community members who are democratically elected by beneficiary community to run the regular activity of water supply schemes. The services years of water committee are two years. The number of water committee members is seven for motorized schemes and five for shallow wells fitted with hand pumps. To enhance the gender participation in water supply scheme management, the guidelines depict at least two of the water committees are female. The water committee member consists of chairman, secretary, treasurer, storekeeper, care takers (2) and counselors. In general, there are about 7200 water supply schemes managed by water committees in the region.

The water committee is headed by chairman who reports to the Woreda Water Office and tothe local community.

The information obtained from Oromia Water Resources Bureau shows that the challenges faced by many of water committees in the region is failure to meet at least cost of operation, maintenance and repairs. The causes for failure of operation and maintenance cost were due to mismanagement finance obtained from water fee collection.

Water Board: - is established by motivation of two or more water committees who have got access to potable water from the same sources. The general assembly of water committee

members is those democratically elected by beneficiary community. There are 28 rural water supply Boards and each Water Supply Boards consists of 7 to 40 water committees. The major constraints of Water Boards in the region are multi village rural water supply system incurs high cost of operation and maintenance cost especially those schemes constructed by governmental organization. Whereas, management of those water supply schemes constructed by NGOs are successful. For instance, Robe Meliyu, GondeIteyaandDodota which were constructed by NGOs.

The Indigenous Water Source Management:-The Borena people have their own long traditions of developing and managing water supply sources. Those long traditions include how and when to utilize water sources. Accordingly the right of water usage depends on its scarcity and labor and material contribution. Surface water such as river, or that found in natural depression or pool after the rain storm is regarded as gift of God for all use. Water that has been contained by pond or ella (traditional well) developed by human labor is subject to greater regulation. The Borena'sella administered by abbahirega (father of the ella) who have the responsibility to oversee the operation and maintenance of ella.Everybody comes for watering livestock have to participate in disilit the ella(Rural Water Supply Scheme Management guide lines, 2002).

Technical factors

The technical factors to be considered in this literature reviews are: Technology, operation and maintenances. Operation and maintenance activities are the most important activities to be under taken if sustainable and adequate potable water supply service is required. It is the cornerstone of system management without which reliable service cannot be ensured. Problems with the operation and maintenance of water supply and sanitation have long financial status and are a good progress towards full cost recovery. It is not uncommon to find that attention is mainly or

exclusively focused on the construction of new water supply systems. Frequently no provision is made for operation and maintenance of the existing supplies. In fact maintenance is one of the most neglected aspects of rural water supply projects and the numbers of in operative systems remain discouragingly high. International and bilateral agencies often offer funds for new construction but are not so readily prepared to finance maintenance costs, considering this to be the responsibility of the recipient country (Ayele, 1986).The operation and maintenance requirement should be a major consideration when selecting or developing appropriate water supply technologies and organizations for rural areas. If the technology chosen is relatively complex involving for example motorized pumps and treatment plants operation and maintenance in rural areas is likely to be a major problem. Although no system is maintenance free careful provision has to be made even for the simplest systems (protected dug wells, Hand pump systems and springs) by using simple technologies of low maintenance requirements. Once a water supply scheme is provided, it is important to ensure that the community continuous to rely up on it. Thus it is essential that the system is kept continuously operating. If it breaks down, and remains in operative for long periods of time due to poor maintenance, people will return to their traditional water source. The opportunities for improving the attitude towards safe water supply will be lost, probably for years (ibid).One of the major problems in rural water supply in Ethiopia is the question of sustainability due to inappropriate choice of technology like the installation of Boreholes with electrical pumps which often becomes in operational since the beneficiaries neither have the technical know-how nor the financial capability to make repairs on the systems. From this stand point, the preference is to go for simpler and more sustainable technologies like spring development and hand-dug wells fitted with hand pumps. These technologies offer

beneficiary participation both during implementation and operation stages and consequently enhance sustainability of Systems (Mengesha, 2002: 40).

In undertaking water development projects, the first step is that all water sources should be assessed, so that the most suitable and acceptable source can be selected. Different sources of water require different degrees of treatment which have marked bearing on the cost of installation. The choices of source and technology used to determine the sustainability of water supply systems. The case study of Ethiopia points out that in remote rural areas borehole equipped with motorized pumps have resulted in failure as these did not afford simplified operation and finance opportunities. In another situation, the case study of Ethiopia makes reference to two successful spring-based gravity water supply systems (Dodota and GondeItaya) which did not require treatment. In one of these systems, women were owners of the system and in both cases community participation was very high (ECA, 1999:28).

In rural of Africa, integrated water management is undertaken depending on the water source, technical knowhow, and financial availability and affordability. The sources of water may be from rivers, springs or groundwater. The general practice in remote rural areas has been the application of labor-intensive technology in the development of water resources. For better success to be achieved there is fundamental need to build up technology capacity within the countries in Africa to solve problems and to a void undue dependence on imported technology and raw materials. In the area of development of hand pumps, the examples of Zambia, Malawi, Ethiopia and Ghana among others can be cited. Most of the hand pumps are manufactured locally, they are easy to operate and maintain and are produced at considerably low-cost than imported hand pumps (ECA, 1999:39).

Some reports from Ethiopia as well as other developing countries showed that insufficient and in appropriate technology accounts for the failure of some water supply schemes and insufficient water facilities, poor physical structures, low reliability of the services and facility designs, the distance and time needed to collect water and low awareness about their uses. These factors affect the continued functioning and utilization of water supply schemes. Although several water supply projects have been constructed in Gonder area, the majority of them are reported to benon-functional at present affecting a significant proportion of users. This highproportion of non-functional schemes resulted in inadequate drinking water Supply which adversely affects personal hygiene, clean food preparation and housing sanitation, which in turn, bring about the transmission of water-borne diseases (Mengesha, 2002).

Rural water supply and livelihood

An evaluation seminar held in 1992 as a follow-up to the first UN international Decade for Clean Drinking Water (1981-1990) found that half of the incidents of infant and child mortality in Central African Republic were due to water-related diseases. WHO estimates that in 2005, 1.6 million children under age 5 died from the consequences of unsafe water and inadequate hygiene. In order to reduce the mortality rate of the child we have to provide clean water with adequate sanitation facility. It protects children from water-related disease and enables them to get enough nutrition (Teshome, 2006).

Improved water supplies lead to both direct and indirect opportunities for improved productivity. More water, of better quality and provided more reliably, can provide the water needed for productive activities like irrigation of a backyard or community vegetable garden or for micro-enterprises like hair salons or tea shops. These direct benefits are what most of the experiences

identified in this top seek to capture. But indirect gains may be even more important in that they can apply to both water-based and non-water-based activities. Saved time and money can be invested in activities that bring positive returns to capital or labor (IRC, 2003).An intriguing and important study in Gujarat, India (James et al., 1992), showed how significant improvements in incomes were achieved when an improved water supply that saved women's time was combined with promotion of handicraft-based rural enterprises. These enterprises did not significantly depend upon making productive use of domestic water but the better supply enhanced productivity through timesavings. This project illustrates the utility benefit of water but the important messages that just providing the utility was on its own less effective than doings in conjunction with a program that supported the women in making use of the timesaver. It demonstrates a livelihood based approach which realized that time and timely access to other key assets is a prerequisite to making money. In order to maximize the benefits of the improved water supply it was necessary to address constraints associated with these other assets.

Many women in rural areas are caught up in the routine of fetching water from distances of 3 to 6 kilometers. A disproportionate part of the day is spent in obtaining water for the family. Regardless of the amount of water needed, there is the health implication and the depletion of the Woman's energy for other activities which in some areas is reduced by 50%. The role of women as the group who are custodians and guardians for food and water requirements for the household should be taken into account by planner and designers of water schemes (ECA, 1999).

Warner (1974) gave an example of the complexity of the influence of diseases in an African setting. An African house wife gets up in the morning and soon begins to fetch water. She walks through the thicketed Savannah to the water source. This is the habitat of tsetse flies and she is

exposed to reaches the water source in a valley bottom and has waited her turn. This is the habitat of disease-bearing mosquitoes and of a different tsetse fly more efficiently transmitting Bilharzias if it is sluggish or may contain guinea worm larvae if it is a mere muddy hole. She collects the water, which today bears a dilute load of human excreta and may contain typhoid bacilli or hepatitis virus. She returns, past the tsetse flies, to her home. As a result of her trip she has been unable to day any digging for the past hour and fewer crops are grown. She prepares the family's main meal. The scarcity of water discourages the washing of hands before the meals and makes washing up after the last meal. Some decayed food may be left on the utensils. Some UN boiled water is drunk by her thirsty family, who pick up the germs from it. Two days later father falls sick. The cattle are not tended properly and the cotton is not planted-latter in the year there is no money for school fees since not only was the harvest small but also part of the available cash had been spent on medicines. A little had also been expended on getting the children spent by the government on medical facilities used in treating the water borne diseases or insecticides to kill mosquitoes breeding in and around the water holes and on providing chlorinated water for a nearby town. Because of the difficulty of

controlling all of the relevant health-related, as well as social and economic variables' in such a setting, conclusion concerns causes and effect relationships often are colored by the strong likelihood that some un suspected or un measured factor was responsible for the observed result. Nelson Mandela said '' When I return , as I often do, to the rural village and area of my childhood and youth, the poverty of the people and devastation of the natural environment strike me painfully and in that impoverishment of the natural environment, it is the absence of access to clean water that strikes most starkly. Among the many things I learnt as president, was the

centrality of water supply in the social, political and economic affairs of the country, the content and the World'' (World Submit on Sustainable Development,2002).

Locating improved water supplies within reasonable distances to households saves time and possibly increases production time. Some studies find that, improving accessibility by constructing boreholes in villages in Nigeria reduced daily water fetching times from 360 minutes to 45 minutes. Through rain water harvesting, women in Sri Lanka saved 2 hours (opportunity costs) daily by a reduction in the number of trips to dug wells and springs from 8 to 3 per day. As a result, rainwater consumption increased in dry and wet seasons between 50 to 70%. Such substantial amount of time saved could improve women's welfare through time and energy availability for productive time in developing countries. Studies show that time saved by women is channeled into house work (for example, cooking and hygiene), rest, social and personal activities. Others allocated time saved to having quality time with the family whilst a few invested this time into agricultural and cottage income generating activities. Mozambican women, allocate time saved between housework such as grinding grain, rest and leisure with very little allocated to agricultural production.

NGOs involvement in provision of water supply

In any development project or program, clearly defined indicators are essential for accurately and realistically measuring results toward goals and objectives. Within the context of participatory management, the process employed to realize these results is also key' capacity building is one of the main requirements for achieving progress. The maintenance of water and sanitation systems how frequently water and toilet facilities breakdown and how they are repaired is determined by a variety of factors: technical, motivational, community capacity to operate and maintain the

systems, cost and availability of spare parts, private sector or NGO involvement and government support system. Because the cost of setting up centralized operation and maintenance for hundreds of scattered water systems is prohibitive, increasing emphasis is being placed on standardized technology and creating management systems that include communities, the private sector, NGO and local municipal involvement and government support systems. In most countries, governments retain the responsibility for training of mechanics and care takers to correct major breakdowns. The training may be contracted to the private sector or NGOs. Several external, multi and bilateral agencies and Nosier operating in Ethiopia. It is noted that in some of the countries the number of NGOs

Operating in the water sectors is so numerous and their activities are not coordinated. There are NGOs that plan implement and handover water schemes to communities which in a few years become in operational. The activities of some NGOs are not even known to the responsible government water offices. Such chaotic situations should be corrected through joint arrangements between the government responsible offices and NGOs. So that partnership may attain the desired objectives (UNECA, 1999).

Water supply Development in Oromia

Since 1993 the Regional State took the responsibility of developing rural and urban water supply. Between 1993-1995 Water Supply and Irrigation was a department under the Bureau of Natural Resources and Environmental Protection. Again in 1995, Water supply was restructured as Bureau of Water, Mines and Energy Development. Since 2003, Oromia Water Resources Bureau was organized and became fully responsible for water supply development and management. During these periods, achievements were registered in provision of water supply. Concerning

water supply development the evidence indicates that attention was given for urban water supply development. This can be evidenced by looking at the access to potable water supply at the end of 2003, 17.7% rural and 72.8% urban and the overall access to water supply in the region was 23.5%. Due to the efforts made by governmental and non-governmental organizations, the number of people with access to potable water supply increased from 23.5% to 36.2%, while for urban and rural it increased from 76.3% to 83.9% and from 30.1 % to 42.8% respectively at the end of 2005. Although the number of people with access to potable water supply increased from 4.5 million to 11.2 million in the region, given the rapid population growth of the region, the challenge was not simple to fulfill the demand for potable water supply (OWRB, five years strategic planning, 2006).

Water supply Development in Bora woreda

Following the decentralization policy of the country, Oromia Water Resources Bureau had stretched its structure up to Woreda level in 2004. The Woreda water office was established with responsibility for provision of rural water supply. The problem of rural water supply was very serious in Bora woreda before 2000. Since 2000, as a results of efforts made by both governmental and non-governmental organizations, water supply coverage increases from 19% in 2000 to 48% in 2011 (Survey 2011). The 2011 rural water supply scheme inventory data of Bora woreda indicates that there are 21 motorized deep wells, 16 shallow boreholes. The shallow boreholes are concentrated aroundLakeElen and koka. The deep boreholes are the most important in analysis of potable water supply system as these as most part of the population depend on these sources. The survey data shows that there are 21 deep boreholes equipped with diesel driven motor pumps, about 16 shallow boreholes fitted with hand pumps. From the total of 21 deep

boreholes 6 were non-functional. The non-functional schemes in this account about 29% of the existing water supply schemes in the study area. The information obtained from Bora Woreda Water Office confirms that **t**he non-functionality of water supply schemes were mainly due to lack of spare parts, poor financial management by water supply and sanitation committee and lack of logistic at local level and poor quality of groundwater mainly due to high fluoride. It is learned that all the water sources in the area have fluoride content more than 1.5 mg/l WHO standard upper permissible limit

Water Source Potential

Surface water

The surface water in the area is seasonal and perennial. The seasonal surface water is the rainwater during the wet season mainly during the months of June-September. It exists as stream flow and stagnant water in depression. The second surface water is perennial water source mainly awash river, Elen natural lake and Koka Artificial dam. Description of the major perennial surface water is given as below.

Awash River: The Awash River flows southeast from High Mountain at the western margin of the Main Ethiopia Rift, west of Addis Ababa around Holeta where it collects discharges of many small springs emerging from slopes of trap basalt and ignimbrites (Berhane, 1982), in a relatively steep gorge up to 25 Km upstream of the Koka Dam with very low gradient. Immediately downstream from the Koka Dam, the Awash River formed relatively deep gorge on the up faulted and fault dissected horst, and meanders up to Awash Melkasa. In the downstream area of the dam, minor ephemeral and intermittent stream often flowing only for 3 wet months (July, August and September) feed the Awash River. Internal drainage areas also exist around Gedemsa Caldera area

(SileshiMamo, 1995). The river has relatively narrow course/out let across Hippo fault Scarp, at Wonji Gorge. The Awash River descends from Awash Melkasa, downstream of Wonji Sugar Estate, NE ward with low gradient, except at some volcanic ridge and scarps, to the southern Afar depression where it terminates into the lake Abe, at the border to Djibouti. (SileshiMamo, 1995).
Koka dam: The Koka dam is the only artificial Dam that regulating the Awash River in the Upper valley and the koka release together with the downstream joining streams supplies water for existing 69,000 ha of farm in the lower Valley. During drought years, water shortage is often encountered even for the existing farms. And the reservoir water was operated according to the Hydropower demand. But currently it has come to be used as per the downstream irrigation water requirements (SileshiMamo, 1995).

The Koka reservoir is exhaustively suffering from silt sedimentation. Siltation rates of 26.4 Mm^3/yr and 25 Mm^3/Yr were estimated for the years 1969-81, and since 1981,

The reservoir is losing its water through evaporation and ground leakage. Average annual evaporation loss of 309.9 Mm^3 was estimated by Halcrow, 1989.The recharging water from surface and Sub-surface aquifer in to the Dam is common in all part of its surrounding except in the North eastern shore of the Lake where dense fault observed and in which the reservoir potential leakage occur (SileshiMamo, 1995).

Halcrow, 1989 has proposed rising of the Koka dam by 1 to 3 meters. Every meter rise in the water level is supposed to add over 178Mm^3 of storage capacity, and can increase the reservoir life by probably a minimum of 7 years.

Elen Lake: Lake Elen is the small in size and found on the western part of Koka dam. The community around the Lake have highly affected tooth and spinal cord because of the higher

concentration fluoride from the hand dug wells near the lake which is the only source of water for public consumption. According to the local community near to Bericha Mountain (directly South of Koka), the ground water comes from the Lake Elen (from western to Eastern part) and that is why water near to Bericha is high Fluoride concentration. But the water that comes from Koka side (northern part) is relatively small in the concentration of fluoride. It is easily observes the groundwater direction in the hand dug wells near to bericha that comes from western part.

The lake has been also irrigated for the production of different vegetation in its vicinity.

Photo 1: Partial View of Koka Dam (Abiyu, 2007)

Groundwater

From hydro geological view point, Bora Woreda is relatively high in groundwater potential. The highly fractured and inter-granular aquifer in alluvial and lacustrine sediments favored the storage and circulation of groundwater in the Woreda. The recharge is from inflow of water from eastern and western Ethiopian high lands bisected by the Ethiopian rift valley and point precipitation. The

occurrence of high ground potential is evidenced by previous hydro geological work and high yielding boreholes drilled in the Woreda. The yields and characteristics of the developed water sources described as below.

Hand dug wells: a plenty of hand dug wells are found near Lake Elen and Koka lakes for public & livestock consumption, small scale irrigation and washing purposes. Depths of the dug wells vary from 3-33 m with variable static water levels of 1 m – 21 m.

Most of the dug wells provide a perennial source of water and however, yield is substantially decreasing during dry season. The seasonal fluctuation of the static water levels in most of the wells is highly attributed to the direct recharge condition from precipitation into the well which intern indicates the unconfined nature of the aquifers.

Boreholes: Both deep and shallow boreholes are drilled in the study area by Governmental, non-governmental and private Drilling Company. There are about 21 deep boreholes where the depth varies between 61-2000 m and 16 shallow boreholes of 33-60 m depth range. Most of the deeper boreholes are fitted with submersible electrical pumps and the other boreholes are equipped with Indian mark II and Afridev hand pumps.

The main aquifer formations of the boreholes are Lacustrine deposit, weathered and fractured Basalt, ignimbrite, rhyolites &trachytes and welded tuff having a variable thickness and variable weathering and fracturing intensity. The static water level of the wells lies within the range of 8.6 m for shallow well of 24 m total depth to 100 m for deep borehole well of 268m total depth. The yield of deep borehole is greater than 5 liters per second.

The article presented below gives field facts where over 15 liter per second deep borehole was successfully drilled for at DalotaBosokie village. The is water is taken also for Alemtena town

where water problem is severe. The article is testimony of the water potential and importance of drilling rig to donors and other stakeholders.

Photo 2: DalotaBosokie deep Borehole 15 liters per second (photo by Bekele Abaire)

Flows in the vicinity of Koka Dam for shallow aquifers

As confirmed from the previous works and the current study, groundwater flows towards and away from the surrounding of Koka Dam. The dam also received groundwater though its bed which consists of slightly consolidated lacustrine deposit, which is covered by thin silt sediment, has moderate to high permeability in the area of unconfined aquifer nature.

The reservoir area seems discharge area for local descending groundwater, and the deep regional ascending groundwater head seems stabilized at the level of reservoir floor.

According to the previous work and the current study, it is confirmed that the dam receiving water from south, north and north-west of the surrounding and in turn discharge to north-eastern of the dam as the potential area for leakage of the dam.

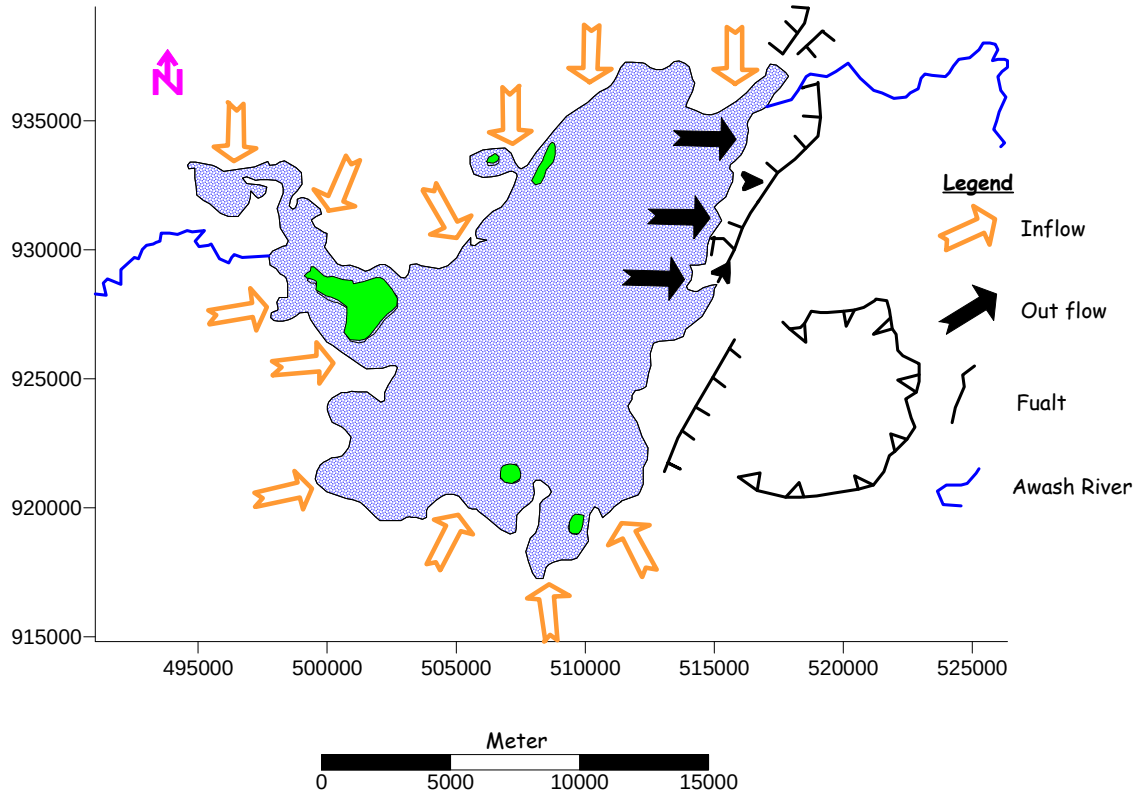

Figure 2:Groundwater flows near to Koka dam (Modified from Sileshi, 1995) for shallow aquifer

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The reservoir area was a permanent marsh before impoundment and this suggests ground water discharge but previous water balance data for the reservoir show high negative leakage value, which evidence high groundwater inflow into the reservoir, more than groundwater discharge at the peripheries or shore areas.

Water depth in the Koka dam may not receive regional deep groundwater which could be supported by high aquifer temperature found below Koka town.

CHAPTER III

3. RESEARCH METHODOLOGY

3.1. Study Area

The project area (Bora Woreda) is located within the Ethiopian rift valley in East Showa zone, Oromia region. The capital town for the Woreda is called Alemtena. Alemtena is located 110 kilometres south west of Addis Ababa and is accessible by asphalt road that runs from Addis Ababa to Moyale, below is Figure 3, location map of project area

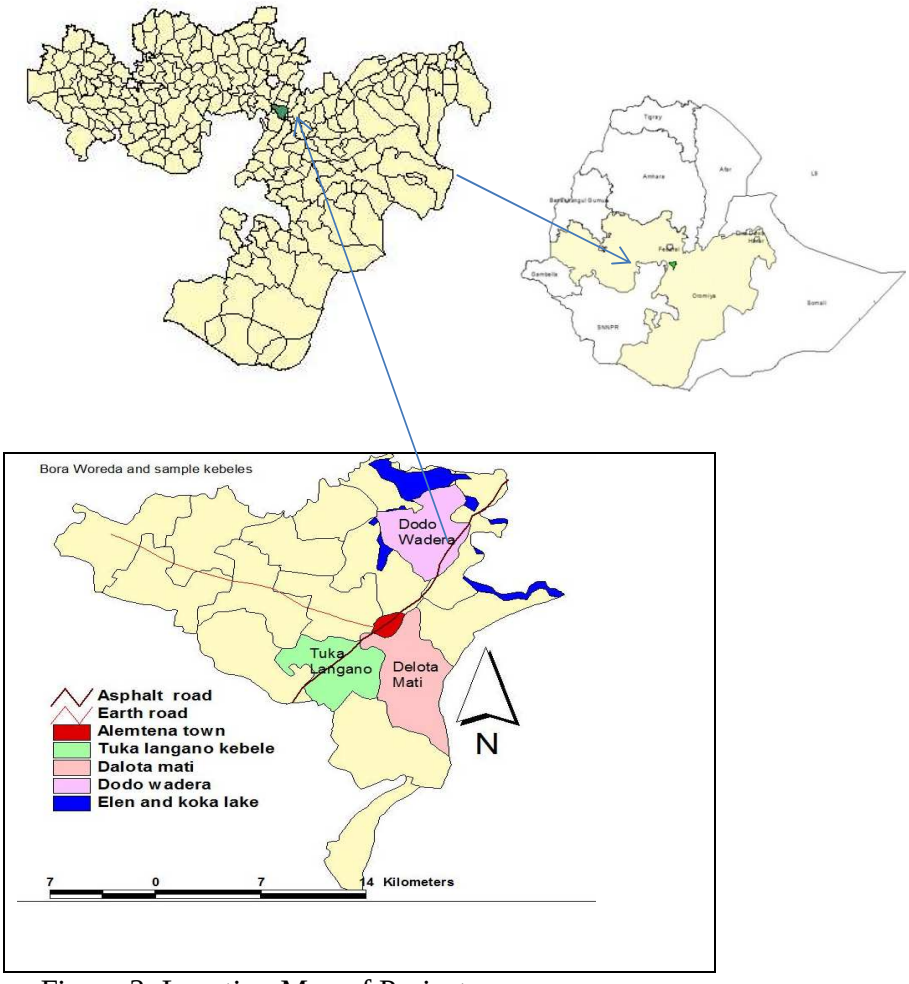


Figure 3: Location Map of Project area

3.2. Location of Study Kebeles

There are 17 rural kebeles in Bora Woreda. Out of 17 kebeles, three kebeles were selected for the research. These include TukaLangano, DalotaMatiand DodoWadera. The household survey was collected for these kebeles by the researcher which was planned for this study. The location of kebeles selected for the detailed household survey is presented (Figure 4).

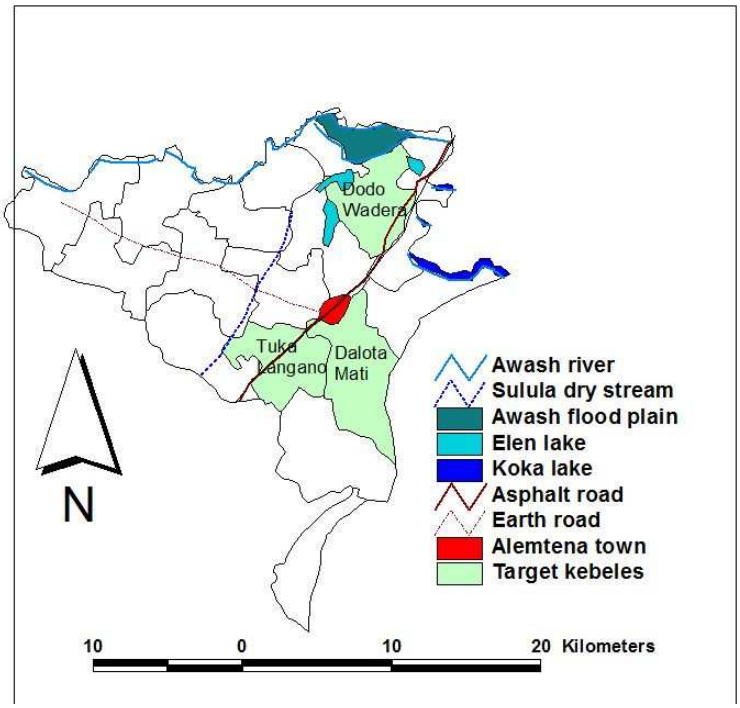


Figure 4: Location of Study Kebeles

3.3.Accessibility

The area is crossed main asphalt road that runs from Addis Ababa to Moyale. There are dry weather trails (roads) within the woreda and in dry season these trails are being used intensively to transport people using cart. The peculiar thing which could be mentioned about the Woreda is the extensive use of cart to transport human, water and other goods in any direction at any time of the day.

3.4. Climate and physiography

The area receives the mean annual rainfall between 700 – 800 mm. The mean annual Potential Evapo Transpiration (PET) is between 1400 and 1700 mm which is much more than the mean annual precipitation. The average annual maximum and minimum temperatures are 25-27^{0}c and 12-16^{0}c respectively. The relationship between precipitation and PET indicates that the area is moisture deficient, to this effect, the woreda hardly favors a single season production within the range of 61 and 90 days crop growing period.

Both crop production and animal husbandry are important in the woreda. Major annual crops are maize and sorghum; while livestock production includes cattle, goat, sheep, and equine. The land-cover types are predominantly of Acacia spp., wood land and open grass land usually intensively cultivated.

The natural resources of the woreda, especially land and land covers, are being depleted at an alarming rate. Increasing of Livestock and human population puts a great pressure on natural resources.

The Woreda used to be one of the main centers for the supply of charcoal and fuel wood. The local communities exclusively depended on the natural biomass for local fuel energy. The sad

aspect of it is that there has not been effort/development to replace in part or full the abusive harvest of woods. Even at present, local effort to reforest or look for alternative energy source is minimal.

Deforestation, being one of the major problems of the environmental degradation in the Woreda, specifically affected the land cover of the area by exposing the fertile top-soil to severe erosion both by run-off and strong wind. As a result, moisture and productivity decline from time to time. The expansion of gorges and river banks and the development of gullies in the middle of the plain topographic feature are good examples of natural resource mismanagement in the area...

The environmental degradation is the main cause of the prevailing severe food insecurity in the area. The rural poor are getting poorer and poorer and are now depending on non-farm income sources such as migratory unskilled labor, fuel wood sale, etc.

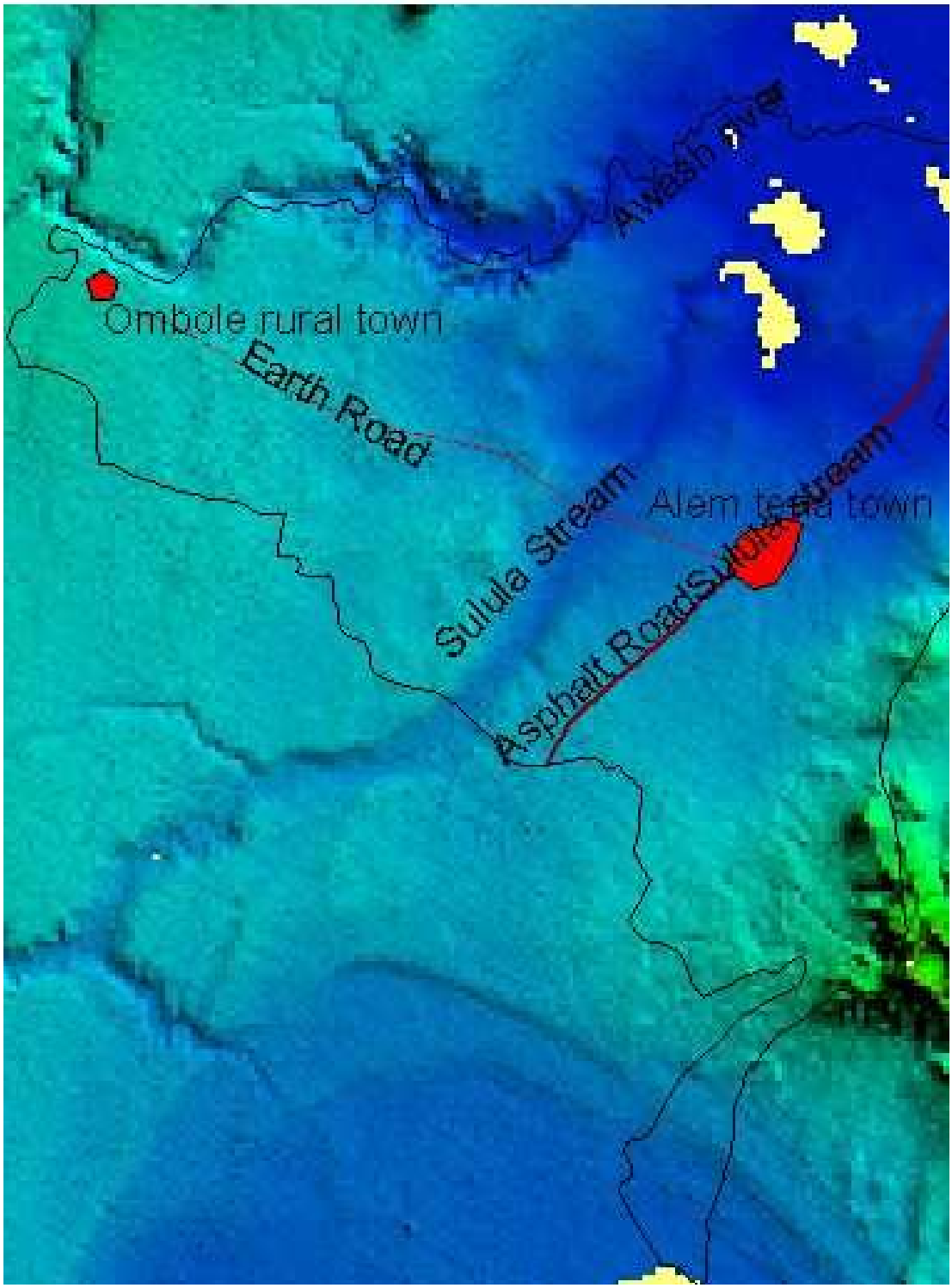


Figure 5: Physiographic Map of the Woreda

3.5. Data Sources and Collection Instruments

A combination of both primary and secondary data sources was used for the study. Secondary data related to impacts of rural water supply and management systems on the livelihoods of the user communities were collected from various reports and publication, different publications of ministries and regional government, thesis paper, online and electronic data bases and reports of various organizations. The methods employed for primary data collection include household surveys, key informant interviews (formal and informal), observation method and focus group discussion.

Household survey a total of 100 households were surveyed in three research kebeles out of which 53% were male and 47% were female participants. The survey was conducted to collect data on the role of WASH in the livelihood of user community with sampled people in the selected rural kebeles Administrations. A multi stage sampling technique was used for data collection as follows:

Selection of Kebele Administrations: The kebeles administrations were selected based on representativeness, accessibility and availability of improved water supply scheme. Stratified sampling method will be used for the selection of Kebele administrations.

Selection of villages or communities: Communities for the study were selected from three kebele administrations based on availability of improved water supplies, the representativeness of their water supplies tothekebele and accessibility. In villages/community selection, purposive sampling method was used.

Selection of households: The households' selection within a given village was carried out at the start of the first survey by using random sampling method. One day training has been given to the

interviewers by the author on the various procedures to be followed in the selection of respondents and on how to conduct the interview.

Prior to commencement of actual data collection, pre-testing carried out at selected households to check whether the questionnaire for household surveying is workable or not at the existing context.

Focus group discussions (**FGDs)** conducted particularly with water users' committee members, elders, healthy extension workers and DAs to gather group opinions.

Observation: Visits to key sites such as water sources, sanitation facilities, households, schools, etc. is the best and the quickest method to understand how the system functions. It also helps to know the demands and needs of the population to eventually develop new solutions or improve the old ones. Photographs assist with the documentation of observations.

Pictures can be used to remind certain facts and to illustrate the issue or information of others.

Observation can be used as a supportive or supplementary technique to collect data that may complement or set in perspective data obtained by other means (Robson, 1995). Observation employed to observe and record the status of water supply schemes and managerial capacity of water committee at water points. The observation method has enabled the researcher to have knowledge about improved water supply scheme management and benefits of improved water supply from the beneficiary perspective. Furthermore, sanitation and hand washing facilities and utilization were observed. Photographs were part of the assessment instruments to pick up the status of different water supply schemes.

Key informants interviews carried out to collect background information on institutional set up, operation and maintenance, impacts of improved water supply and strength of water committees in scheme management. The interviews held with selected individuals who were believed to have good knowledge about the subject matter. The key informant interviews were held with the Head of Woreda Water Office, Zonal Water Office, and Meki Catholic Secretariat office representative, operational in Bora Woreda.

Informal discussions held with different categories of people at WoredaLevel (experts at Water office, Health extension worker, and elders).

Mapping: Water Sources inventory made using Global Positioning System. Then the water points and institutional toilets mapped using ARCGIS computer software

3.6. Sample Size

From the total of 17 rural kebele administrations in the Bora Woreda, three kebeles selected by using stratified sampling techniques. These kebeles are in general selected purposely. The main reason for selecting these kebeles includes their accessibility, high population density and sever water problem. For household survey, simple random sampling was employed. Interviews were held with heads of the households selected.

3.7 Data Analysis

Analyzing the data is a crucial part of the study. After data collection, the information organized, analyzed and interpreted. For data analysis, combinations of quantitative and qualitative methods used. The data collected through household survey, FGD and physical observation analyzed by using qualitative method in a way to better complement and describes variables in the existing conditions of impacts of rural water supply and management on the livelihood of the user

community. A method used for quantitative data analysis was descriptive statistics: like percentage, average and tabulation. The SPSS version 17software program was also used for data analysis. Furthermore, ARCGIS version 10 was used for mapping the water point and institutional toilet distribution. Computer based Digital Elevation Model used the physiographic feature of the woreda

CHAPTER IV

4. RESULTS AND DISCUSION

4.1. Target Area Population Characteristics

According to the 2007 population and housing census, the total population of the Bora *Woreda*was58,739 (urban 11,400 rural 47,339) in 20107. This population size of the *Woreda* was projected, to be 65,855 (urban 12,781 rural 53,074). The projection was made using average annual growth rate forOromia region which was 2.9 % in 2007 (Table 1).The crude population density of the *Woreda*was 23.66 persons /km2.

Table 1: Population of the Target *Woreda* by Settlement and Sex

	Urban + Rural			Urban			Rural		
	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female
2007 Census	58,739	30,478	28,261	11,400	5,806	5,594	47,339	24,672	22,667
2011 Projection	65855	34170	31685	12781	6509	6272	53,074	27661	25413

Table2 belowshow that 100 household representatives were surveyed in the three study*kebeles* out of which 47% were female. Here, high female representation in the interview was done purposefully because this group of the communitywas the one who was affected more than their

male counterparts and thus could provide more reliable information regarding problems related to water and sanitation.

Table 2:Household Survey Respondents by Sex

	TukaLangano			Dodo Wadera			MatiDalota			Total		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Respondents	16	14	30	16	20	36	21	13	34	53	47	100
% of sex	53	47	100	44	56	100	62	38	100	53	47	100

Source: Household Survey Report, December 2011

There were two major ethnic groups in the area, Oromo (83%), Amahara (12%) and the remaining 5% are Gurage and others. All respondents were married (Table3).

Table 3: Ethnic Backgroundversus Marital Status

	Oromo	Amhara	Gurage	Other	Total
Number of Respondents	83	12	2	3	100
Married	83%	12%	2%	3%	100%

Source: Household Survey, December, 2011

4.2. Socioeconomics Characteristics

Agriculture: As table 4 illustrates, Agriculture was the dominant economic activity and the base of livelihood for the majority of the households of the study area. The agricultural activities in study area were characterized by mixed farming system which involved crop production and livestock rearing. Cereal crops produced in the woredawere sorghum, maize, teff and wheat. In addition to cereals, pulses and oil seed, such as haricot bean, ground nuts were produced. Regarding fruits and vegetables, onion, sweet potato, tomato, pepper, papaya and mango were the major ones that were produced in the Woreda. The agricultural sector was atsubsistence levelor onlyfor household consumption and not geared to markets. Next to agriculture, crafts were the secondary source of income. The major types of trading activities undertaken were marketing of agricultural products, private petty trading and opening up small shops. Thus, we can see learned that 93%, 3% and 4% of the respondents participated in farming, trade and crafts, respectively (Table 4).

Table 4: Occupation of Household

	Occupation			**Total**
Indicators	Farming	Trade	Crafts	Farming
Number of respondents	93	3	4	100
Percentage	93%	3.0%	4%	100%

Source: Household field Survey December, 2011

Education: The level of education of the rural people would give an idea as to their potential for implementing income generating and other activities or achieving certain objectives such as operation and maintenance, financial management and local institution capacity. The study shows that about 58% of the respondents were illiterate and 8% the respondent households can read and write having basic education in the study community (Table 5). It was found that the illiteracy rate in the study area was very low.

Table 5: Education Level of Respondents

		Level Education					Total
Sex of HH		Can't read & write	Read & write	Grade 1-6	Grade 7-10	> grade 10	
Male	Count	23	5	19	5	1	53
	%	43.4	9.4	35.8	9.4	1.9	100
	%	39.7	62.5	73.1	71.4	100	53
	% of Total	23	5	19	5	1	53
Female	Count	35	3	7	2	0	47
	%	74.5	6.4	14.9	4.3	0	100
	%	60.3	37.5	26.9	28.6	0	47
	% of Total	35	3	7	2	0	47
Total	Count	58	8	26	7	1	100
	%	58	8	26	7	1	100
	%	100	100	100	100	100	100
	% of Total	58	8	26	7	1	100

Count= # of respondents

Source: HH Field Survey Data, December, 2011

Income: The house hold income is another important criterion to decide on thecapacity of households to afford paying water fees. On the average, a household in the study area earned annually Birr 7878 and 5428 came from crops and cattle sales,respectively (Table6).The income from sale of cattle account to 31%.

Table 6: Annual Income of Households from Crop and Cattle Sale in birr

Statistics		**Income from selling of**		
		Crop	Cattle	Both
Mean/Average		5428	2354	7874
Percentage per source	Mean	68.94%	31.06%	100%
Lower and upper bounds	Lower bound	3502	1705	5483
	Upper bound	7353	3003	10265

Source: HH Field Survey Data, December, 2011

4.3. Water Sourcesand Sanitation Facilities

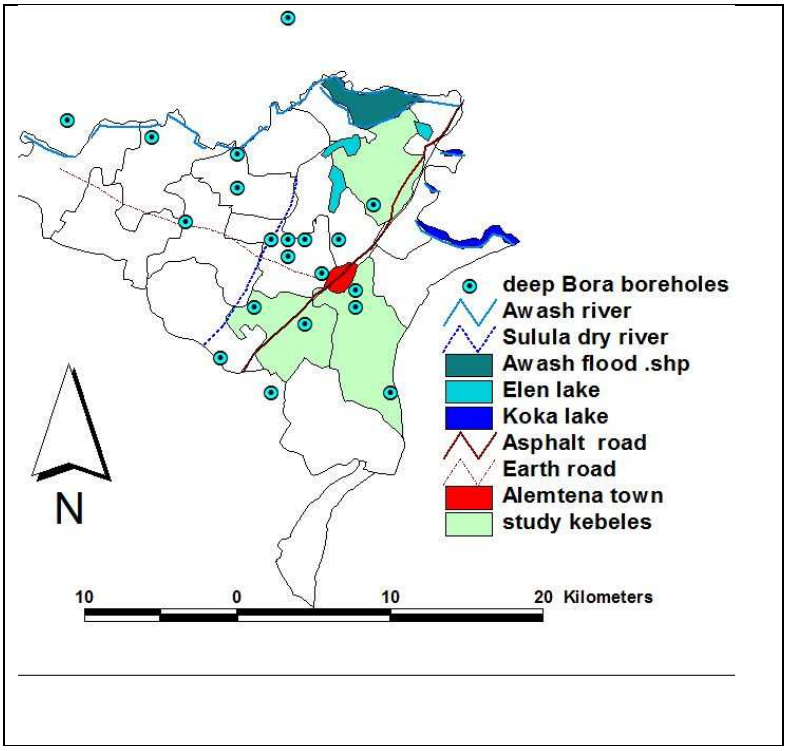
Water Sources

As table 7 shows, almost everywhere in the study area, deep wells, river and lakes were used for human and livestock consumption during the dry season. In the wet season, road-side and other inundations were used for both human and livestock consumption. At the beginning and end of the rainy season dry river-beds were mined for water supply. Roof water harvesting in the *Woreda* was almost non-existent due to the use of traditional thatched-roofed houses (East Shewa Zone Assessment Report, 2010). Catholic Relief Services (CRS) introduced the system in few schools. However, the general trendindicated the construction of houses with corrugated iron sheet is

increasing. This implied, promoting rainwater harvesting would be advisable as this would contribute to availing good quality water near the household.

The water source potential (both ground water and surface water) was generally high in the Bora *Woreda*. Ground water potential seemed to be divided into two broad categories: (1) some nine kebeles bordering rivers and lakes had high water table and the inhabitants used shallow wells for irrigation and for human and livestock consumption. Other kebeles located away from these water sources used deep ground water extracted with the help of motorized pumps and this was identified by the researcher during survey in December 2011.

Water sources inventoried by the researcher weremapped (Figure 4.6). As can be seen from the map people in the central and western part of the Woreda had no option except deep boreholes which needed power for pumps. People living in the eastern and north eastern part of the Woreda could get water from surface water (lakes and river). However this, Surface water was generally not safe as it is exposed to animals and wastes. The groundwater in that area was also not safe as it had high fluoride content.



Source: Field Survey, December 2011

Figure 6: Deep borehole distribution in Bora Woreda

According to the information extracted from household survey(Table 4.7), 77.6% of the total sampled households in all villages collected water from surface water (river, unprotected spring or well or mix of sources etc.), while only 22.4 % collect water from protected sources (protected spring or well or protected shallow or deep boreholes). Depending on the season and proximity to their residences people collect practice collecting water from mixed sources. As presented in the table people may collect water from protected or unprotected source. This implies the awareness of the people using safe water is low.

Table 7: Water Source Condition of Target *Kebeles*

Description	**Number of Respondents**	**Percent**
Surface water	49	50.0
Unprotected spring or well	13	13.3
Protected spring or well	17	17.3
Borehole	5	5.1
Other	1	1.0
Surface water & unprotected spring or well	7	7.1
Surface water & protected spring or well	1	1.0
Surface water & other	4	4.1
surface water, unprotected spring or well and borehole	1	1.0
Total	98	100.0
Missing	2	
Total	100	

Source: HH Field Survey Data, December, 2011

The daily water consumption of a HH varied from place to place based on the availability of water sources (protected and unprotected). Those HHs close to the water sources had access to more water and those far away consumedless water per day. According to the information obtained from FGD, the average water collected per day per household was two Jericans of 25 liter capacity each. This was also in line with the results obtained from household survey done by the researcher and colleagues. In that study, the median number of liters used per person per day as reported by households was nine (ranges 5 – 12)(MWA-CNHF survey November, 2011).

The same household survey study indicated that target communities spent a median of 291 minutes (range 80.1 – 467.8) to travel to and from their houses during dry season, including waiting time; during the rainy season that time was reduced from 80.1 to 58 minutes. Based on these reported travel times, the median distance to primary water sources was calculated to be 9 kilometers` (range 2.7 – 15.6 kilometers) during the dry season and 1.9 kilometers during the rainy season. The target communities relied on surface water for 5 months during the past year.

The JMP classifies improved access to water as use of an improved water supply system (borehole, protected well or spring, piped system, etc.) within 1 kilometer of a home or dwelling. Due to difficulties related to terrain, scattered settlement pattern and high investment, the Ethiopian WASH strategy classifies improved access to water as use of an improved water supply system , etc.)Within 1.5 kilometer from home or dwellings and 15 liter per person per day.Both FGD and household survey analysis indicated that the distance and volume of water needed per person per day was not to the standard, either of JMP or of country.

Regarding water quality and use management, most of the interviewed households (66%) used plastic containers - usually Jerry cans to fetch water, 33% clean water container at least weekly and 75% monthly. It was observed that during the house to house survey, about 46% of the containers were not clean. Some households use i*nsera*[1] and barrel. The estimated capacity of one Jerry can was 25 liters, and an *insera* was 10 liters. Water was mainly used for cooking, drinking, washing utensils and bathing. Furthermore, the respondents indicated that water filtering was mainly using a piece of cloth.

The study participants were asked if they got adequate water throughout the year. Both men and women participants responded that they did not get adequate water for domestic as well as for livestock purposes. On top of that, the participants were asked about their opinion on the cleanliness of the existing water sources. Participants from Dodo said that their water sources were not clean; the sources were full of snails and dirt, and people shared the water with livestock. In addition, villagers from all sample kebeles (Dodo, Langano and Dalota) stressed

[1] I*nsera* is a traditional container made up of clay and carried on women's back, which is normally considered as a woman's object, and men do not carry water-using insera. Men often share the responsibility in fetching water but with jerry cans. However, driving barrels is usually the responsibility of men and young boys.

that the fluoride was high in water and was resulting in health hazards. The researcher observed people fetching water from unprotected lake water as indicated in the photo below.

Photo 3: Young girls fetching water from Ellen Lake

The discussion with participants, particularly the women participants, indicated various diseases related to the current water sources. These can be categorized as water-related (such as diarrhea, typhoid, intestinal parasites, etc.) caused by contaminated water, and hygiene-related (such as scabies, conjunctivitis, pediculosis, and trachoma) caused by lack of water for personal hygiene. Unclean water from the sources coupled with poor handling and inadequate health services in the area caused serious health hazards to the community members. This is supported by information from health office, where most of the diseases were classified as the top ten diseases in the Woreda. In addition, fetching water from distant places was tiresome to women due to heavy load of the water they carry.

According to 2011 study undertaken by National Floursis Mitigation office under Ministry of Water Sources and energy over 11 million people of the Rift Valleyand almost 8.5 million (below 40 years of age) would be at risk of developing dental and skeletal fluorosis if they continued to

depend on drinking water from wells with high fluoride concentration (ReddaTekleHaimanot, 2005).

The researcher's long term experience in the project area and information gathered from secondary data and discussion held with key informants indicated that Bora Woreda was among the Woreda severely affected with dental and skeletal fluorosis.

Concrete available data from government and non-government organization archives reveal that over 90% of deep, andshallow boreholes in the Bora Woreda used for drinking have fluoride above the WHO optimal level of 1.5 mg/l for fluoride, which is the case for dental and skeletal fluorosis of children, and old men & women, respectively(ReddaTekleHaimanot, 2005). The same study indicated that, the presence of fluoride in ground water could be as high as 25 ppm. On the discussions held with communities and stakeholders' meeting, it was noted that the fluoride situation with ground water in particular was an important health issue. There was also consensus that the risk tended to be undermined probably due to lack of information and public awareness on the risks of the high fluoride content to human morbidity and mortality.

Photo 4: Skeletal fluorosis (adult men)

Photo 5: Dental Fluorosis left mother, middle boy and right young girl

Another major problem in the Woredawas non-functionality of existing water sources. According to information from Woreda Water Officeat any given time over 29% of the 'safe' water sources are not operational (East Showa zone water office, ECCSDCOM and CRS Joint Water Source Survey Report, 2011). During the survey it was observed that most of the water points were either under-utilized or not in use at all because of:

- Decreased efficiency of water pumps due to long years in service; and
- High downtime due to lack of maintenance capability.

It was learned in group discussions that there were some wells inoperative for two to three years. There had not been a systematic assessment to establish causes of failure. Capacity to do this was lacking both at the community and Woreda levels. Appeals to the zone and regional authorities whenever the opportunity presented itself have not been heeded.

Ongoing attempts on mitigation of fluorosis

Possible control options to protect the fluorosis problem may include provision of alternative source of water, blending with low fluoride containing water, provision of bottled water, at least for young persons, treatment of the water supply at source and at the point-of-use. In areas where alternative sources are not available and the provision of bottled water is not economical, as in the

case of the Bora Woreda, treatment of contaminated water is the most reasonable approach. Household and community scale water deflouridation was successfully applied in India using the Nalgonda technique, which uses aluminum sulphate in combination with lime (NEERI, 1978).

ECCSDCOM have been involved in various community development and health projects. Provision of clean water for the rural communities is one of the activities being performed in several villages in Bora Woreda. The ground water in the area hasvery high fluoride content (Felekeetal, 2002). Although the water obtained from deep well had low risk concerning microbial contamination, it contained toxic fluoride, which causes long-term health (Feleke: Community Managed Deflouridation System, 2002).Therefore, it was appropriate to find solution to this problem in order to ensure the safety of drinking water. Thus CRS in collaboration with Addis Ababa University and ECCSDCOM has initiated water deflouridation project. This is the first pilot scale study in Ethiopia by employing three locally available materials in the target area(FelekeZewge, Bekele Abaire and Messele Endalew: Community Managed Deflouridation System, 2002).

The major objective of the project was to pilot three deflouridation systems in the target area thereby reducing the fluoride content to less than 1.5 mg/l according to WHO standard or at a maximum of 3 mg/l (according to experiences of other countries (FelekeZewge, Bekele Abaire and Messele Endalew: Community Managed Deflouridation System, 2002).The specific objectives are to:

- Test three low cost water deflouridation methods under field conditions to determine the technical and economic feasibility in rural communities

- Develop community support systems to make deflouridation sustainable in the Ethiopian context

The researcher had assessed the status of these technologies through observation, discussion with communities, FGD and key informants. From the research it was learned that communities had adequate knowledge about the health risk of fluoride. However, the practice of treating water with the constructed treatment plants were taken up by the community as anticipated. The major reason mentioned during the study was that since the effect of fluoride on health was slow, communities had not given due attention. Other reason mentioned mainly by water care takers were challenges in getting chemicals and spare parts in the area for running the system.

Sanitation facilities

Access to improved latrines was higher in the target Woreda than any parts in Ethiopia 8% (JMP report 2008). Nearly 17% of respondents had constructed improved latrines in their homes (Table 8). Of those without a latrine, the main reasons reported for not constructing one included don't need one (22%), do not like (15%), cost (15%), lack of knowledge to construct (3%), and no manpower to construct (17%) andculture (6%).

Brief Description of the Arborloo:

The Arborio is a very shallow pit that is designed to be, eventually, a home for a fruit tree.

A pit about 80 centimeters deep and 60 centimeters in circumference is dug and dry leaves are added to the bottom. A simple concrete slab is placed over the opening. After each use, a cup of a soil/wood ash mixture is added to encourage soil composting (which kills fecal pathogens), to reduce smell and to discourage insect breeding. A very simple superstructure can be added for privacy. This toilet is used by a household for one year and then the slab is removed, the pit is topped up with good topsoil, and a fruit tree seedling or other crop plant is planted in the former pit. As the roots grow downward into the pit, the seedling takes up rich nutrients which result in a very healthy fruit tree that produces in abundance. It is very friendly and applicable for pastoral/agro-pastoral communities.

In addition, since Arborloo toilets are shallow, there is less likelihood of ground water contamination or collapse during the rainy season. Because the pit contents are full of carbonaceous material (feces, ash and leaves), they act as a sponge. To date, there has been no report of Arborloo pits flooding and spilling their contents in the rainy seasons because the carbonaceous material absorbs water. Traditional pit latrines flood because the excreta material is hard and compact at the bottom and overly liquid near the top, creating ideal conditions for filling and then flooding with dangerous excreta. Thus the Arborloo is a safer toilet option for the protection of ground and surface water sources.

The constructed latrines were of different types. Most of the respondents were using traditional latrine while17% of them were using properly constructed latrine with locally available material which had cement slab with cover and shelter. The latterwas ecological latrine namely Arborloo. Arborloowas innovated latrine promoted by CRS and its partner. The latrine was used for multiple purposes excreta disposal and tree/fruit growing (See box above). It wasalso learned that only 28% of the people utilize the improved toilet properly and 72% uses open defecation. This percentage included depositing of feces from children <5.

The benefits of latrine were more privacy when defecating, defecating any time of the day, prevents flies from resting on faces, a cleaner environment, less contamination caused by open defecation, decrease in incidence of diarrhea and etc. This would be achieved on properly constructed latrines with cover and shelter.

Table 8: latrine Coverage, practice and reason for not constructing

	Number of respondents	Percent
Improved latrine in use at HH (has washable slab)	57	17
All HH members >5 years use latrine	60	28
Open defecation in HH (including depositing of feces from children <5)	60	72
Reason for not having latrine		
don't need one	24	22%
don't like it	24	15%
cost too high	24	15%
don't know how to construct	24	3%
no manpower to construct	24	17%
cultural reasons	24	6%

Source: MWA-CNHF: Baseline survey November, 2011

As presented in the table9 over 71.9% of the respondents indicated that livestock are kept in the compound during the night while only 5.2% of the respondents indicated that livestock spent in

house during the night. This implies most of the respondents kept their livestock separate from the people during the night which is hygienic.

Table 9:Where livestock dospent the night

Description	Quantity	Percent
In the house	5	5.2
Within the compound	69	71.9
Other	1	1.0
Not applicable (don't have livestock)	16	16.7
In the house & within the compound	5	5.2
Total	96	100.0
Missing	4	
Total	100	

Hygiene practice

The proportion of respondents whowere washing their hands at critical times was higher (Table 10).The critical time of hand washing include after defecation, before eating, before food preparation and feeding the child and 26.3%, 14.1%, 18.2% and 2% of respondents confirmed that they practiced the hand washing respectively.Over all 39.4% of the respondents confirmed that they practiced hand washing after defecation, before eating, before food preparation & before feeding the child and after changing the baby. The existing hygiene behavior practice is generally below average and implied future intervention.

Table 10: Hand Washing Practices at critical times

Activity Description	**Number of Respondents**	**Percent**
After defecation	26	26.3
Before eating	14	14.1
Before food preparation	18	18.2
Before feeding the child	2	2.0
After defecation, before eating, before food preparation & before feeding the child and after changing the baby	39	39.4
Total	99	100.0
Missing	1	
	100	

Source: Household survey December 2011

The practice in the use of detergents for hand washing is very important. Because it helps to clean disease causing pathogens. As presented in the table 11 below 76%and 6% of the respondents washed their hands with soap and water, ash and water respectively.Eighteen percent (18%) of the respondents confirmed washing their hands with water only. Over all the finding implied the number of respondents that used detergents for hand washing was above average. This is generally good practice and needs to be encouraged.

Table 11:Use ofDetergents Frequencies for hand washing

Activity Description	Number of Respondents	Percent
Soap and water	76	76.0
Ash and water	6	6.0
Only water	18	18.0
Total	100	100.0

Source: Household survey December 2011

4.5. Water, Sanitation and Hygiene Service Management

The household survey result indicated that the selection/construction of schemes is participatory among community, government and NGOs. In the household survey, the high percentage (44% in this case) of the respondents indicated that the schemes were constructed by local community &NGOs,(Table 12). Communities were involved in construction of water sources with government and NGOs. This in turn implies thatmost of the respondents participated in technology selection, election of water committee members. It was also shown that the water committee had ability to manage the water schemes if they could get technical and financial assistance from the local government. In general, the data in table below indicates that community involvement in water supply project started from project identification and finally took over the management and operation of the water schemes. Despite the fact that communities participated in all stages of the projects, still the communities did notunderstandthe proper management of water points. The implication is that there was no monitoring and follow-up by local government after the schemes were handed over to the communities.

In order to get information in wider community WASH management group discussion was made. Women, men, girls in school, and boys in school were interviewed. In one case, over 50 men participated in the FGD.

Women as the members of the householdwere principally responsible for water collection due to tradition and culture. Girls, and sometimes boys, fetch water for the household. Some communities reported accidents, falls, and encounters of wild animals, as risks associated with

fetching water. Likewise, most FGD respondents designated women and girls as primarily responsible for collecting and disposing of waste.

Most communities with an improved source had a water committee that charged water feesbetween 0.25 and 0.50 birr per 25 liters (a Jerican). In a typical response across all respondent groups, community members in BoraWoreda had very poor knowledge about hygiene issues, even though there were health extension workers.

Table 12: Participants as to who constructed water sources

The water point was constructed by	Responses	
	Number of Respondents	Percent
Constructed by regional government	18	18%
Constructed by NGOs &Government.	35	35%
Constructed by local community & NGOs	44	44%
Constructed by Government & local community	3	3%
Total	100	100%

Source: HH Field Survey Data, December, 2011

Regarding the selection of the type of technology, about 97.8% of the respondents had selected motorized schemes. This was attributed to the fact that the major water source in the area wasdeep groundwater which needed high power to pump water. Furthermore, people require more water for multiple purposesmainly fordomestic and livestock.

This selection was in agreement with the information obtained from FGD. In the discussion, the

FGD indicated that deep boreholes were their preference as other water sources (river and lake) were far from where most community lived. FGD indicated that the only problem with deep borehole was high fuel consumption of generator, absence of spare parts in the area and limited capacity of Woreda water office to backstop.

4.7. The Impacts of Water Supply on Livelihood of People in Bora Woreda

Forty eight point four percent (48.4%), 36.1% and 15.5% of the respondents indicated that the major problems in the their included spending more time in fetching water , problems related to water borne diseases and high drudgery for women & children to fetch water.

Table13: Interviewee responses as to why water sources were neededinterms of time, health, andWork load

	Number of Respondents	Percent
More time were spent to fetch water	47	48.4
Problems related to water born diseases	35	36.1
Drudgery for women & children to fetch water	15	15.5
Total	97	100.0
Missing	3	
Total	100	

Source: HH Field Survey Data, December, 2011

The respondents hadalso indicated new water sources had multiple advantages on the wellbeing and livelihood of people directly and indirectly. About87% of the respondents stated that the new water sources were closer to their houses. The respondents claimed also the new sources mainly boreholes had more water (38%), it was reliable (permanent) source (29%) and needed less time to collect water (40%) (Table4.14).

Looking only from domestic use perspective,10.5%, 55.9 and 33.4% of the respondents confirmed that the developed water sourcessaved more time is available for productive activities & more social & domestic activities, improved health of family members, and relived drudgery for women and children respectively(Table 4. 12). This implies access to safe and adequate played multiple roles in the livelihood of the community.

Table 12: Interviewee responses on benefits gained from improved water supply Interms of health, women work load, time and other

Description of Activities	Number of respondents	Percent
More time is available for productive activities & more social & domestic activities	10	10.5
Health of family members has improved	55	55.9
Relieved drudgery for women and children	33	33.4
Total	98	100
Missing	2	
Total	100	

Source: HH FieldSurvey Data, December, 2011

The house hold survey findingswere also supported by key informant case studies and gave in depth understanding of the area.

One informant, **Abu Alemu from Langano village of TukaLanganokebele** administration said that “prior to the development of the water project, the water sources for domestic and livestock were traditional ponds andElen in our village’’. Abu is 28 years old and he is operator for Langano borehole. Abu indicated that ElenLake is located over 10 kilometers away from our village. These water sources were not only in accessible but also not clean. We were assumed as ignorant people by both governmental and non-governmental organizations. But we knew that people were using improved water supply in the neighboring kebele administration like Tuka and

Tejitu. During dry season, ponds get dry out and women and children were travelling a long distance (up to 6km) to fetch water for domestic use from boreholes in the adjacent kebeles.Many people were also suffering from water borne disease and women and children were forced to spend most of their time for fetching water from long distance and men are spending most of their times in searching water for livestock.' I stopped my study from grade due to water problem. Water has meaning for me. I know motor operator and receive monthly salary of 300 birr. Now, I will plan to complete my dream that is education through distance learning. After we started to use improved water supply, our children became happier and healthier''. According to Abu the villagers saved money used to be spent for health treatment related to water-borne diseases.

An informant named **NegewoFolieWonji,fromDalota village in DalotaMatikebel**e administration said that we were using water for drinking and cooking from lake koka during dry season and standing water in depression and ponds in rainy season.Negewo is 32 years old and he is the water committee chairman of DalotaBorhole. The water was always turbid and unclean. The family members were attacked by diarrhea. We did not know the exact causes of diarrhea at that time. But the health professionals were told us the causes of diarrhea was polluted water. We were spending a lot of money for medical treatment of family members. We had to travel over 10 kilometers double trip daily to fetch water from this unprotected source. At that time over 80% of women and children's work is fetching water. Women whose families do not have donkey were responsible to carry ontheir backs 25 liters capacity Jerricanor 15 liters capacity clay Jar.In general, we were suffering from the lack of potable water supply for a long time. We had no right to use water supplies from another kebele, because we didn't make any contribution during the construction of water supply schemes. But after the construction of water supply schemes in our village the health of my family members were improved and the expenditure for medical

treatmentwas also reduced. Many people in our village use the single water point today and no travelling ofa long distance to fetch water. But we suffer more when the scheme is interrupted/broken down because we had already adapted to drinking clean water supply from the developed water point and was difficult for us to go back where we were used to.

One of the most important benefits accrued from improved water supplies, and certainly the easiest to measure was saving in time and energy spent for collecting water. The distances utilized in the analysis of the impacts of time were the normal walking routes reported by the heads of house hold in the household survey. The variables measured for the impacts of time included the one-way walking distances for each individual house to its usual source of water. The average time spent for fetching water from traditional source was about 291minutes (MWA-CNHF survey, 2011) and the average time spent for fetching water from improved water supply source was30 minutes. This implied that there was a significant reduction in time spent for fetching water after the provision of improved water supply. Access to potable water supply within 1.5 km for rural people and access potable water supply within 0.5 km for urban people is the standard set by Ethiopian government (PASDEP document, 2005/06). The reduction in time revealed that the impacts of using improved water supply was resulted in time saving and energy spent for collecting water, since the current water source is closer than the previous water source. Energy and time saved from using improved water supplies had solved the burden on women and children of rural community in the study area, as they were the principal collectors of water. The implication was that reduction of time spent on water collection could mean more time for income generating activities, food production, childcare, nutrition and health. Improving water supply conditions to cut down the time women spent for collecting water could hence unlock the

productive potential of women's time and energy. The reported distances of the respondents' water sources from their home were more or less moderate.

Time estimates were also not reliable since most of the respondents were illiterate. What would be needed were detailed time-budget studies of water carriers, who in most households were women and children. Such studies should include measurement of the amount of water carrying time "saved' as well as the effects of these savings on both earlier and new activities.

4.8 Economic and Social Impacts of Water Supplyin Bora woreda

The impacts of rural water supply on the livelihood of the user community

Lack of access to water supply has impacts not only on the quality of life, but also on productivity and health. The study showed that improved water supply had brought improvement in health, saving time and energy spent in fetching water from far distances and improvement in income of user people. This indicates that provision of improved water supply could play a decisive role in social and economic development. When it comes to the impacts of water supply on the livelihood of the user community, 31.9%asserted that there are some changes in the livelihoods ((increased income 20.6% and increased productivity of livestock 11.3% (Table 14). Similarly, 68% of the respondents' asserted that the health of family members had been significantly improved after they started to use improved water supply. This implied that public health and water supply were undeniably linked together. Improvements in family members' health were essential and better health was a prerequisite for economic growth. Ill-health limits the ability to earn higher incomes. Reduction in poverty is possible only when steps are taken for better health of the people

Table 13: Interviewee responses on the impacts of improved water supply interms of income, human health and livestock

Description	Number of respondents	Percent
Household income has improved	20	20.6
Health of the family has improved	66	68.0
Productivity of livestock has improved	11	11.3
Total	97	100.0
Missing	3	
Total	100	

Source: HH Field Survey Data, December, 2011

The FGD panelists fromTukaLanganokebeleequated 'water with life'. They stated that we had better access to water supply and we were using it mainly for livestock. The study also revealed that access to potable water supply provided better hygiene and sanitation for members of water supply user communities. They confirmed that accessing to potable water supply at their village enabled the whole community to experience better hygiene and sanitation. The head of Bora Woreda health office confirmed that water borne diseases decreased significantly in the Woreda since the establishment of potable water services. According to the Woreda Health Office Statistics (2006), water borne diseases ranked to the fifth place in the study area.

The informants responded to the question whether the supply of water had brought any change to their livelihood as below.

An informant named LomiIffa (40) living in Langanovillage stated that after we had started to use improved water supply, the health of our family members and livestock had been improved. Similarly, a development worker in the same kebele confirmedthat "the accessibility of water supply, most particularly for small scale production and the attainment of income increments have

been achieved. Health extension workers RozaHailuof LanganoKebele and AbebechGezu, of Dalotakebele also underlined the significance of improved water supply in family health improvement and time saving. They also added the prevalence of water-borne diseases in villages where there were no improved water supplies. To tackle the prevalence of water -borne diseases, the health extension workers haddistributed water purifier tablets (agar) freely for the treatment of unimproved water supply. The short term solution to protect the people who are using unimproved water supply sourcewas continuous distribution of water purifier tablets. The shortcoming was that, those villages adapted water purifier tablet (agar) would face serious health problems when the distribution of the tablet was interrupted even for one week. They further tried to point out that the reasons for health problems occurred when the tablet was interrupted is the loss of resistance due to adaptation of water purifier. Another informant named Sultan Haji WASH expert in Bora Woreda Water Office asserted that many people used to be attacked by wild animals like Hyena, while searching for water in dark before the construction of water supply schemes. After provision of improved water supply, the user communities started to get safe and adequate water at reasonable distance from their homes. He added that the improved water supplies had brought the following significant changes in Bora Woreda in general:-

- It created moral satisfaction to the user community and improved the childcare of mothers.
- It relieved the drudgery of women and empowered them economically by having Water at home for livestock and generating income from selling the livestock.
- It increased the participation of women in political and social activities in some kebeles.

According to information obtained from ECCSDCOMsenior agronomist AsnakeDebela and ShanbelLenjiso senior development worker in Bora Woreda, the improved water supply was used

for drinking, washing, livestock watering and production of onion, tomato, coffee and sweet potatoes. Asnakeadded that small scale irrigation groups with average of 10 people per group established. The irrigation users were provided with inputs like improved seeds, pumps and farm tools. Their memberswere also provided with training on agronomy and water management. The use of water supply for small-scale production has direct relations with improvement in income of the user community. The field evidence showed tells that the group got income of birr 40, 0000 to 60,000 per harvest. This implied that the userhouseholds whichhad access to small scale production (gardening) earned on average 4000-6000 birr per harvest.

Photo 7: the small scale production at Ellen

Livestock was the major income for livelihood of the people. According to Dalota water committee chairman the highest volume of water (over 80%) was consumed by livestock and every day an average of 1000 livestock came to the water borehole site for drinking.

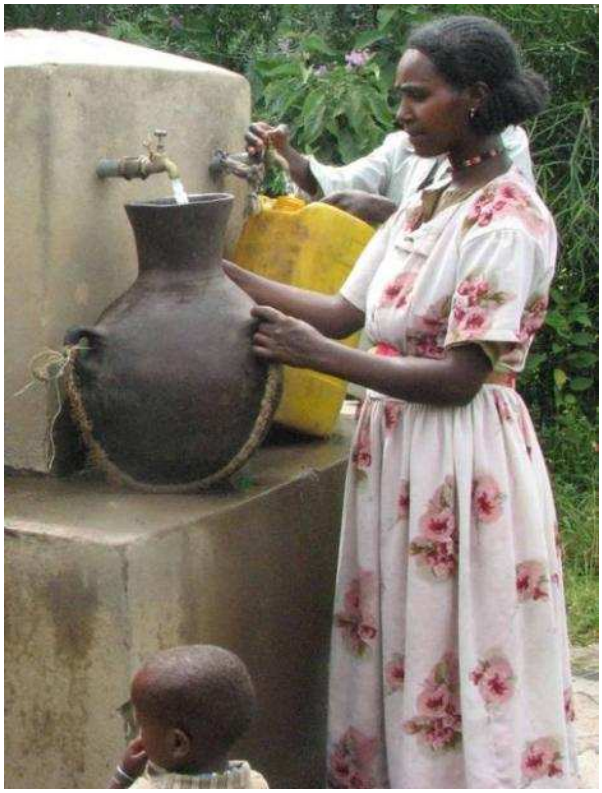


Photo 8: LomiIfacollecting water from developed water source

In general, improved water supplies in the study area had both positive and negative impacts on the user communities. The information obtained from Dalotakebeleindicated that there was loss of farm land at source and water point areas. For instance in DalotaKebelethe sand production and trade resulted in deep valley erosion, which significantly affected the farmland. Another impact observed was land degradation around the water points due to the use of animals for transportation of water and livestock watering (refer to photo 9 below). Conflicts were also reported in some kebeles. These conflicts, according to respondents were mainly due to different competing water use interests and clan differences. One cited conflict was provoked between two clan on TuteKormite borehole. The clan where the borehole located was reluctant to share with theneighboring one for their difference in clan and due to conflicts that usually happened between individuals from these clans. There were also cases where communities did not allow residents

from other villages to use their water schemes for other factors. This was attributed mainlyto high population pressure and people from other villagers were not willing to contribute when there was scheme breakdown. This implies that the development of water supply schemes was directly or indirectly affected the livelihood of the user community as well as the neighboring people.

Further discussions made with elders revealed that conflict resolution was transparent and resolved by informal institution Idir (Sabunta). The community of Bora Woreda had strong traditional management system locally called Gada system. Due to existence ofidir and gada system, management of conflict is very strong. Therefore, conflict around water use and management system was not a major concern in the area.

Photo 9. Land degradation around Dalota water supply scheme

CHAPTER V

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

In general, two major issues have been spelled out from the study. These include:

1. Water supply and sanitation projects had impacts on people's lives which extended far beyond the expected improvements to health and reduction in time spent collecting water. The study showed that impacts could include significant improvements in household income levels and security of livelihoods. Increased school attendance occurred along with better child care, social and cultural benefits such as reductions in stress levels, increased status and self-esteem, better family and community relations, and increased ability to observe religious rites and customs.

The need for improved water supply is widely recognized as an essential component of social and economic development. Safe water is essential to the protection of community health by limiting the transmission of water-borne diseases. At the same time, it contributes greatly to the enhancement of human dignity and economic opportunity by freeing people, mainly women and children, from the drudgery of carrying water and providing them time to engage in other activities.

The household survey data also revealed that the livelihood of the user community in the study areas had been improved after they started to use improved water supply. The improvements in livelihood were manifested in terms of improvement in health and time saving in surveyed communities. The findings of the study also revealed that the average time spent for fetching water from unprotected sources was high and the average time spent for fetching water from improved water supply source was much lowers. This implies that there was a significant reduction in time spent for fetching water after the provision of improved water supply. In addition, the capacity building provided to the irrigation user communities through supply of inputs and on water management improved the income of the user community.

The household survey indicated that the water had significant impact on improvement of livelihood of the user community. The respondents asserted that there were some changes in the livelihoods((increased income and increased productivity of livestock) following provision of water supply interventions, most particularly in terms of household health improvement and saving times. Similarly, higher percentage of the respondents asserted that the health of family members had been significantly improved after they started to use improved water supply. This implies that public health and water supply were inextricably linked together. Improvements in family and community healthcarea prerequisite for economic growth.

1. Involving community members in planning, monitoring and management of their own projects brought new insights into both the wider impacts of interventions and the factors contributing to the long-term sustainability of water supply and sanitation systems. Understanding the potential breadth of the impact that water supply and sanitation projects can have on poor people's lives

underlines the fact that access to safe water and sanitation is a precursor to any form of sustainable development. It also provides evidence to reinforce the argument that improvements to access should form the cornerstone of any strategy to reduce or eliminate poverty. Understanding the role that communities can play in participatory impact assessments of projects is vital if planners are to gain information

According to the information obtained from study area, in areas where there was interruption and frequent break down of water supply schemes, the beneficiaries were back to the traditional water sources and sometimes their livelihoods had been affected by water borne diseases and incurred additional costs for medical treatment and spent their productive time for fetching water from long distances. This implies that there was a strong relationship between water supply scheme management and impacts of water supply on the livelihood of the user communities.

It was learned that the status of women was slowly changing as there were a number of women actively engaged in government responsible positions and water committees. For instance, the study indicated that the representation of women in WASH committee was about 30%. However, the target population including women needed to be sensitized about gender and gender in development. Women were the most burdened with daily labor requirements. According to the quantitative survey results and community discussions, rural children especially girls did not attend schools, not only because there was access problem to primary schools, but also to assist the households in the labor needs. The discussants did not deny the improvement from previous periods but suggested the requirement of more attention for further improvement.

5.2. Recommendations

Based on the results of the study, the following have been identified as areas that need further intervention.

A. **Building institutional capacity:** Most of the water committees were weak in capacity to manage water sources. Also, the Woreda water and health offices which were supposed to provide administrative and technical supports were not in a position to discharge their responsibilities. Thus, to bring tangible change in the management of the water points, the intervention has to be geared towards building their capacities.

B. Focus on maintenance and operation: Both governmental and non-governmental organizations focused on construction of new water schemes, whereas the operation and maintenance of rural water supply were in the lowest performance margin due to various reasons, among which, technical and financial short comings were the major ones in the study communities. So, in order to keep a water supply system sustainable, there should be preventive and regular maintenance program by local institutions.

C**. Community involvement:** Increasing the community role in managing water supply leads to better impacts, particularly in operation and maintenance, cost recovery and efficiency. Therefore, the researcher recommends that water service providers should be able to provide appropriate, efficient and sustainable services.

D. Technology: Technology option can enhance, promote or hinder impacts of water supply. For instance, due to the depth of groundwater, diesel driven motor pumps were the only technologies promoted in the *Woreda*. However, it was learned that communities were highly challenged by the increased fuel cost. To overcome the problem, it is recommended that solar pumps be introduced

in the area. The long day (over 8 hours) sun light in the area is an opportunity to promote solar pumps. If need be, the solar can be used in hybrid with wind pump.

E. Water quality: The ground water in the area was highly contaminated by fluoride whereas the surface water was contaminated with microbiological substances. As the main water source of the communities is groundwater, different stakeholders including government and NGO had constructed fluoride treatment system. However, it was observed that the application/utilization of the deflouridation was challenging due to different factors. These include, supply chain for availing spare parts and chemicals, behavior and attitude of peoples on the utilization, absence of technical support and others. Therefore, it is recommended that thorough research be undertaken on the supply chain and behavior and attitude of people for the utilization and sustainability of the deflouridation systems.

F. Rainwater harvesting: During the study, it was observed that several households in the target area had houses roofed with corrugated iron sheet. The researcher feels that this was a good opportunity to harvest and store rainwater which in turn could alleviate water quality problem. Rain-water is relatively safe to drink and increased water supply from roof harvesting may reduce diarrhea incidences and other water borne diseases. It will also reduce burden women and children's burdens stemming from long distance they normally cover every day to fetch water.

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