URBAN WATER SUPPLY, THE CASE OF ASSOSA TOWN

A Thesis Submitted to Addis Ababa University

School of Graduate Studies

Regional and Local Development Studies

In Partial Fulfillment of the Requirement for Degree of Master of Arts in Regional and Local Development Studies

By Assefa Delesho

Advisor: Yohanes G/Michael (PHD)

July 2006, Addis Ababa

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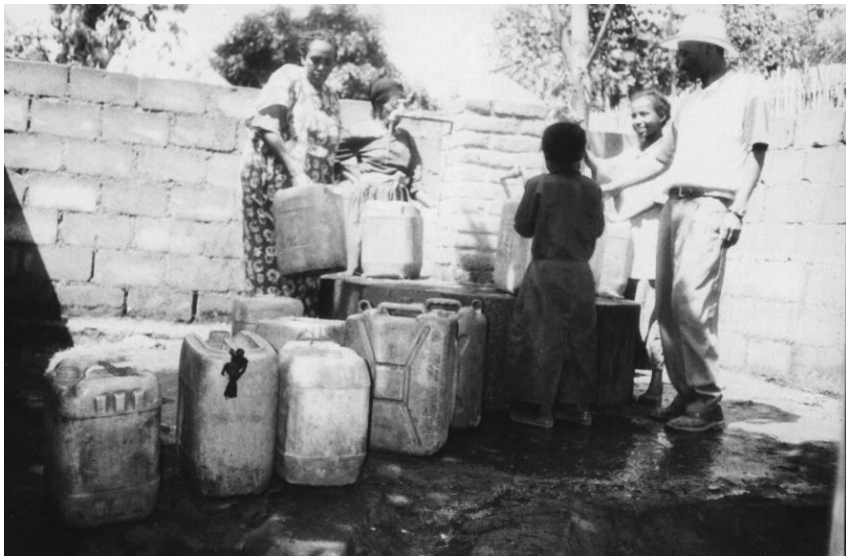

Collecting Water from Public Water Point

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Urban Water Supply, the Case of Assosa Town

A thesis by

Assefa Delesho Kulo

Submitted

In Partial Fulfillment of the Requirements for the Degree of Master of Arts in RLDS, Addis Ababa University, School of Graduate Studies, Department of Regional and Local Development Studies (RLDs)

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Declaration

This thesis is my original work and has not been presented for a degree in any other university and that all sources of material used for this thesis have been dully acknowledged.

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Table of content

CHAPTER THREE

CHAPTER FOUR

CHAPTER FIVE

Acronyms

AAESA: Addis Ababa Water Supply and Sewerage Authority

BGRS: Benishangul Gumuz Regional State

BH: Boreholes

BOFED: Bureau of Finance and Economic Development

BPS: Booster Pumping Station

C^0: Degree Cellecious

CBOs: Community Based Organizations

CSA: Central Statistical Authority

CVM: Contingent Valuation Method

DWSS: Department of Water Supply and Sanitation

ESRDF: Ethiopia Social Rehabilitation and Development Fund

HHs: Households

Km: Kilometer

l/d/c: Litter Per day Per Capita

l/s: Litter per Second

M: Meter

M^3: Meter Cube

MM: Millimeter

MWR: Ministry of Water Resources

NGOs: Non-Governmental Organizations

NU: United Nations

NUPI: National Urban Planning Institute

O&M: Operation and Maintenance

OECD: Organization for Economic Co-operation and Development

PLC: Private Limited Corporation

PMC: Private Meter Connection

RWS: Rural Water Supply Schemes

SWB: Some Scheme Water Boards

TWSU: Town Service Unit

UFW: Uncounted for Water

UNCHR: United Nations Center for Human Settlements

VWSC: Village Water and Sanitation Committee

WB: Water Board

WFO: World Food Organization

WHA: World Health Organization

WMERDB: Water, Mines and Energy Resources Development Bureau

WRDF: Water Resources Development Fund

WSP: Water supply and Sanitation Program

WSS: Water supply and Sewerage Service Office

WSSA: Water Supply and Sanitation Authority

WTP: Willingness to Pay

Operational definitions

Water Supply Service: Providing water for domestic, commercial, industrial and social use.

Domestic Use: Water used for drinking, cooking, sanitation or for other similar purposes.

Industrial Use: Putting water to industrial uses and includes use of water for the production of industrial inputs, making and assembly of products.

Commercial use: Putting water to business related activities such as hotels, bars, recreational areas, markets, car washing, gardens and watering animals.

Social Use: Putting water to social purposes and includes the use of water in hospitals, in religious institutions, educational institutions and government institutions.

Municipal Use: use of water in cities for purposes other than commercial use, domestic use industrial use and social use.

Water Work: Any structure such as pipe line, dam, and reservoir designed to get or store or purify or discharge or control water.

Willingness to Pay: felt need of the community to pay for improved water supply.

Improved Water Supply: Provision of water in good quality or safe for health, good quantity or the required amount of water is available for use any time through out the year; and collection of water need not take much of your time and effort.

Safe Water: the water protected from contamination.

Price Fairness of the price: the level of price that makes the community to be able to buy water supply services.

Operation and Maintenance (O&M) Costs: Operation costs include fuel, staff salaries for the water point, and cost of water treatment chemicals etc. whereas maintenance costs include labor, tools, equipment, spare parts, etc. costs.

Coverage: refers to the proportion of people served with the adequate levels of water supply.

Full Cost Recovery: Covering operation and maintenance, debt servicing and depreciation costs of water supply scheme.

Partial Cost Recovery: Covering operation and maintenance costs of water supply scheme.

Household: any unit of habitual residence where some consumption and/or production may be undertaken in common and where some members may recognize culturally defined relationships of kinship and/or affinity where the members are related in some way.

Kebele: the smallest administrative unit under city or town administration.

List of tables

List of exhibits

Abstract

Assosa town has been experiencing the problem of potable water supply in adequate quantity and quality. Even if the modern water supply system was installed since 1983 and expanded its service by drilling a number of boreholes, still the demand is not satisfied and a number of people do not have access to adequate amount of potable water.

This research has focused on assessing the magnitude of water supply and its challenges and dynamics in Assosa town. A survey was conducted on 196 HHs and interviews with elders, religious leaders, different private and governmental organizations and professionals were held. Emphasis was put on examining the nature of problems of water supply and challenges the service providers and households faced.

The study has confirmed that Assosa town water supply service could not cover the demand of the town with present existing capacity. At present the coverage of water supply is only 38 percent interms of population though the research outcome showed 69.9 percent of the total sample households use potable water. All areas of the town could not get equal and proportional service. Central parts get more water supply while the peripheral areas remain without water. In addition to this, the tariff set is neither affordable nor generates sufficient revenue to sustain the service. The majority of victims of the problem are the poor as they can not afford connection charges. As a result, they exposed to unprotected sources and buy water from vendors at high price. The root causes of the challenging problems are institutional, financial, human and material resource constraints.

The major copping strategies for the challenges are synchronizing different water sources, conserving water sources, family planning, demand management, demand oriented supply, participating different actors, mobilizing financial resources, and staffing organizational structure with skilled personnel and equipping it with material facilities.

Key words: Water supply, demand for water, production, distribution, consumption, tariff, willingness to pay, cost recovery: Assosa.

CHAPTER ONE

1. Introduction

1.1. Background of the study

Sufficient potable water supply is one of the basic urban services, which highly affects the economic progress of towns and the health of their people. However, many urban centers around the world are facing serious problem of water supply. The problem in most of third world countries, including Ethiopia, is particularly worst and multidimensional.

According to Ghrmawit in Pana Press (2004:2) states that the problems are further exacerbated by high population growth and mushrooming towns in Ethiopia. For instance, in 1984 there were 629 locations classified as townships and by 2000 the number had increased to 925, all in need of water supply and sanitation services.

The other issue inviting attention in water supply and sanitation sector in Ethiopia in general and Asossa town in particular is characterized by service deficiency of physical infrastructure as well as by inadequate management capacity to handle policy and regulatory issues and to plan, operate and maintain the service. Inadequate production, together with inequitable distribution system and low quality of water influence the well-being of people in particular and the socio-economic condition of urban areas in general.

It appears to be generally true that small municipalities do not have adequate number of trained personnel in management, accounting and revenue collection, administration, budgeting and service delivery skills and thus unable to raise sufficient revenue to finance and sustain municipal services and urban infrastructure on their own.

Thus, this paper investigates the magnitude of water supply and its dynamics and challenges at Assosa town. Assosa, the capital seat of Benishangul Gumuz Regional State

(BGRS), is located 678 kilometers away from Addis Ababa to the North West. The location of the town is peripheral but it serves as the main outlet for all zones of the region. The fact that Assosa is the capital seat of the region, has contributed to its increase in population, economic development and spatial expansion. This rapid growth of the town has brought about a tremendous increase in the demand for urban infrastructural supply particularly potable water.

1.2. Statement of the problem

Assosa town has been experiencing the problem of adequate safe water supply. The people of Assosa were fetching water from the near by rivers, streams and traditional wells since its establishment (1884). It had been a market center during the five year Italian occupation and later started serving as a regional capital of Benishangul-Gumuz Regional State.

The mean annual rainfall in Assosa town is about 991.5mm and the rainy season extends from April to November. Maximum rainfall occurs in summer (between June and August). However, there is a paradox between potential sources of water supply and amount of rainfall in the town. That is, the water table of boreholes decreases specially during the peak dry season.

A rapid and steady growth of population in and around the town has forced Assosa town to give proper and timely response to urban service demands. This increase which is anticipated to grow more with the emergence of various governmental, non-governmental and private institutions and job seeking migrants in the future means rising demand for additional urban services including water supply.

Due to the aforementioned factors, the existing piped water supply is not adequate for the town. The National Urban Planning Institute (NUPI) final report (1995:18) discloses that the population, which has access to piped water that is not even well purified and treated, is not more than 30 per cent. As such, most of the urban community meets their water

demand by using traditional hand dug well water. The problem of using well water is that they are often located close to toilet pits – not more than 10 to 15 meters. Hence, chances of the water in the wells to be contaminated by wastes from the toilet pits are very high. Consequently, this causes frequent occurrences of water – borne diseases. According to the Assosa Health Center report of 1992 in NUPI (1995:18), water borne diseases were one of the ten top diseases in the town.

The problem of water supply in Assosa town is not only the problem of adequacy and quality but also it has the problem of distribution and reliability. In this regard, Assosa town Water Supply Service Office (WSS) in Yohannes (2004:40) stated that the distribution of piped water and sewerage system covers mainly the central part of the town with an estimated coverage of 30 per cent of the total population. The office also identified that there were 130 domestic, 40 commercial, 64 government institutional connections, and 12 public points of which 2 are nonfunctional. Water supply is intermittent; particularly during dry seasons (February to May). During these periods water is distributed once in three days for a maximum of 5 hours.

According to a number of socio-economic indicators and parameters, services and industrial facilities in the town are also far below the level of the actual requirements. Meheret (2001:7) pointed out that, among the basic services, the water supply system of the town cannot be distributed in adequate amount and quality for the urban community. As reported by the town administration, the overall coverage for potable water is only 17.24 per cent in 2001. CSA report in Meheret (2001:7) revealed that only 855 of the households in Assosa town had access to piped water supply and the great majority or about 948 households used unprotected wells, springs, rivers, and ponds for drinking water.

However, the study conducted by these different organizations and individual researchers illustrate only the coverage indicators of water supply interms of population and its poor quality during the periods of their study but did not indicate reasons for inadequate production; less coverage; limited consumption and fairness of the tariff structure set by

Board. It did not also investigate the prevalence of further demand and the possibility of willingness to pay; the challenging problems that encountered the community due to poor functioning of the water supply system; and the root causes of the problems in detail. Moreover, the service coverage indicators mentioned above were reported before additional boreholes were drilled by the Immediate Rehabilitation and Extension Program which started to give its service in 2004. On top of this, the research tried to indicate the change in magnitude of water supply and its dynamic and challenges.

Thus, to assess the magnitude of existing water supply as well as its changes and challenges, Assosa town is selected as a case of analysis for this thesis. By assessing the magnitude of water supply and its dynamics as well as the challenges that the community of the town and service providers in Assosa town face, the study can bridge the existing research gap and help to plan or replicate the findings for sustainable development of urban water supply in other parts of the region.

1.3. Objective of the study

The overall aim of the study is to assess the magnitude of water supply and its dynamics and challenges in Assosa town. In light of this the specific objectives are:

a) to assess and describe the source, type, state and coverage of water supply in Assosa town;
b) to examine the water demand as well as its supply, adequacy, accessibility, reliability, quality, and sustainability;
c) to assess the water tariff setting and its fairness;
d) to investigate further demand and willingness to pay for improved water saupply;
e) to get comments of the beneficiaries on the proposed strategy by the regional government;
f) to find out the challenges in enhancing water supply in Assosa town;
g) to assess the organizational capacity of mandated agency; and

h) to examine the coordination and participation level of other stakeholders in water supply scheme.

1.4. The research questions

The general and specific objectives of the study would be achieved by way of seeking answers to the following questions.

i) What are the types of existing water sources and supply in Assosa town?

ii) What is the state of existing water supply?

iii) Why demand for water exceeds the supply of water?

iv) Is the tariff structure fair and does it cover cost of the service?

v) Do the urban communities have willingness to pay higher price for improved water service than the existing water supply service?

vi) What are the comments of beneficiaries on the proposed strategy of water supply by the government?

vii) What are the major challenges of water supply in the town?

viii) Do technical, financial and organizational capacities affect the water supply service delivery?

ix} Is there coordination and participation of the private sector, the community, CBOs and non-governmental organizations?

1.5. Significance of the study

Studying the extent and coverage and dynamics of urban water supply service in Assosa helps to identify the pressing problems in service delivery. Thus, the findings of the study are significant for the following reasons:

- the Benishangul Gumuz Regional state (BGRS), especially policy making bodies, and the Assosa town municipality can use the findings of this thesis for designing a more effective method of water supply thereby contributing to narrowing the knowledge gap between supply and demand for safe water supply service;
- it can contribute to the optimal use of water by beneficiaries;
- the research findings can help private institutions to engage in the delivery of this service, provided they are permitted to get involved in the sector;
- Non-governmental organizations (NGOs) which have interest in assisting Assosa town with financial and technical support in the area of urban water supply can use the research outcomes as reference for their objective; and
- The research findings can initiate other researchers to further study the delivery of similar urban services.

1.6. The scope of the study

The scope of the study is limited to domestic water supply and does not include industrial and other consumption of water supply. Due to time and budget constraints, this study is limited only to Assosa town. The sample size is also limited to 10 per cent of the total households in the two kebeles, 01 and 04 of the town, i.e., from the total of 1,955 households 196 sampled households were taken.

1.7. Limitation of the study

The main problem faced by the research process is lack of finance and time. It is impossible to conduct such kind of research without sufficient amount of money and time resource.

The other problem faced in the course of this study is associated with getting adequate and reliable primary data. For instance, the purpose of the study was made clear to the

respondents; however, most people were not voluntary to give the correct information especially about income of the household.

Regarding secondary data collections the problems encountered include the following:

- Some government offices were not voluntary to give the required information;
- Even those that were willing to give their data did not have complete information and the available data lacks quantity and quality;
- Due to poor documentation of the data in the government offices it was laborious to get the necessary and relevant information;
- The structural reform of the public sectors had also an influence on data gathering. Government employees who were responsible for releasing the desired data are newly assigned at the position and do not know much about the issue.

1.8. Nature of data, source and methodology

1.8.1. Data source and type

The research method employed in this research is the survey method. This method was chosen for its low cost and its suitability to observe several cases. The data used in this thesis includes both primary and secondary data. Primary data was collected from the following informants:

Sample households: Only 10 per cent (196) of the total households in Kebele 01 and 04 was taken as the sample size for this study. These 196 sample households were interviewed using closed and open structured questionnaires.

Community elders and Religious leaders: Complementary to the sample households elders and religious leaders of Christians (orthodox, protestants, Catholics) and Muslims were interviewed using unstructured questionnaire.

Institutions and organizations: government organizations and institutions such as health bureau, education bureau, BoFED, government schools and hospital were interviewed using unstructured questionnaire. In addition to this, private institutions such as Dandi Boru School, KIAMED Medical College and "Beteseb" Clinic and NGOS: Action AID, OXFAM, UNCHR were also interviewed. Moreover, different officials and professionals in WMERD bureau, Water Works Enterprise and in WSS office were interviewed.

Secondary data was gathered from secondary sources, including books, study documents, government archives, annual reports, journals, periodicals and other official documents of relevant quality. In addition to these, persona observation by the researcher was used in enriching the data used in the study.

1.8.2. Sampling techniques

One of the central objectives of this thesis is investigating the magnitude of water supply and its dynamics and challenges in Assosa town. To conduct such kind of research, one obviously needs to collect primary data through field research from each and every customer of the service. However, due to finance and time constraints, the research was made to focus on selected households. Sampling technique was introduced to select the target population.

In Assosa town, there are four 'Kebeles' namely 'Kebeles' 01, 02, 03 and 04. The numbers of total household heads and household members in the four 'Kebeles' are about 4,092 and 20,460 respectively. These 'Kebeles' were clustered for this study. Clustering of Kebles was based on the economic status (living standards of the households), population size, and the old and new establishment area of the town. Keble 01 and 02 have similar characteristics except the number of population. The same is true for 'Kebeles' 03 and 04. Thus, from these four 'Kebles', two 'Kebels', i.e, 01 and 04 are selected as the study site. Keble 01 is ancient

and slum establishment area with more population than other 'Kebeles' but resembles 'Keble' 02 in other features. Keble 04 is a new establishment area in which most of government institutions/ organizations and employees are concentrated. The number of people /households in this 'Keble' is less than other 'Kebles'. It has a relatively better living standard compared the residents in 'Kebles' 01 and 02. This 'Kebele' also has similar characteristics with 'Kebele' 03 except its difference in number of population. The town is expanding towards this 'Kebele'.

Therefore, two 'Kebeles' with different characteristics, i.e. the more ancient and slum area (01) and the new establishment and expanding area (04) were selected. From these two 'Kebeles' the households were stratified by occupation as government employees, business men, daily laborers, farmers and others (see annex1). The purpose of this stratification was to form homogeneous groups in order to reduce sampling error. Thus, the sampling frame of this study was the recent (2005) updated household census list of Assosa town and recent updated household lists of the two 'Kebeles' of the town, 01 and 04.

Household is the unit of analysis in the study in which, family head was contacted for interview. Clustered simple random sampling technique was used to draw samples from the entire households in the two 'Kebeles' of the town. This technique helped to refine and improve the sampling thereby raising the representation probability of the sample. The aim of stratification was to create homogeneous groups there by reducing the sampling error at each stage.

It is desirable to have a sample which is representative of the total households of the town as much as possible, but due to time and financial limitations 10 per cent of household heads was included in the sample. Thus, the sample size of the households was 196. The sampling was conducted calculating the per centage proportion of the number of households existing in each 'Kebele' to the total number of households of the town. After

the calculation was conducted the researcher randomly selected sample households from each 'Kebele' based on the per centage proportion.

1.8.3. Data gathering and method of analysis

As indicated above, multiple data gathering instruments were employed to collect data for the study. Structured questionnaire, unstructured interview, personal observation and document analysis were the principal means of gathering the data used in the study. The base for the preparation of final questionnaire was the pilot survey undertaken including 10 households from the two 'Kebeles'. The pre-testing of the questionnaire actually helped in the administration and implementation of the actual survey and in restructuring the questionnaire format and content. The questionnaire included both open-ended and closed-ended questions. Two types of questionnaires were prepared: one for sampled households and the other for different organizations and the service delivering section. Interviewers were recruited and given short-term training so that they would collect the primary data using structured questionnaires. The researcher supervised and managed the interview of the urban households, using unstructured questionnaire.

After gathering the data, relevant statistical methods of analysis were used in order to come up with the appropriate result. The statistical tools like ratios, per centages, arithmetic means, cross tabulation and descriptive statistical methods, time series analysis were employed in condensing the data for the purpose of analyses and interpretation. Also both qualitative and quantitative approaches were employed in the research to the same end.

1.9. The organization of the thesis

The thesis is divided into five chapters. The first chapter covers the introduction part which includes the background of the study, statement of the problem, objective, significance, research method, the scope and limitation of the study. Chapter two deals with the related literature review on urban water supply. The third chapter describes the

study area. The fourth discusses results and findings. The last chapter is the conclusion and recommendations part. Accordingly, the following chapter deals with the related literature review on urban water supply.

CHAPTER TWO

2. Literature Review

2.1. The rationales of urban water supply

Water is crucial for human survival and economic development. The provision of adequate supply of potable water in urban areas in both developed and developing countries is essential for life. In relation to this, Alebel (2004) and Churchill (1987) mentioned that in developing countries the provision of adequate potable water in addition to drinking, cleaning etc. improves health by reducing incidence of water related illnesses such as diarrhea, cholera, and the like. This also helps to reduce both the mortality and morbidity rates and the number of working days lost and increases the GDP. Reducing the incidence of illness will help to slash demand for improved medicine and eases balance of payment problem facing least developing countries. As such, available evidence suggests that there is a very tenuous link between improvements in health and investments in water supply and sanitation services.

In addition to health improvement, studies by Mekonnin (1983), Hofkes, (1986) WHO (1986) in Yimer (1992:3) have shown that the provision of sufficient potable water for people within reasonably short distance from a reliable and acceptable source is a precondition for the people's well being and sustainable economic progress. Hofkes stated:

> *Factors such as time and energy saving in the collection of drinking water and a substantial reduction in the incidence of disease can contribute to development, provided that the time and energy gained are utilized economically…. as many of 80 per cent of all diseases in the world are associated with unsafe water (p.3 - 5).*

Therefore, safe, adequate and accessible supply of water together with proper sanitation are surely basic needs and essential components of primary health care. In addition to that Deieter and Hedeerson in Yimer (1992:4) stated that:

> *Because of an inadequate and undesirable water supply economic loss may result, man power may be wasted, production of consumer goods and food may decline, fire protection may become impossible and schemes for urban improvement such as housing and sanitation may fail.*

Regarding this, the Ethiopia Water and Sanitation Program (WSP, 2002:1) identified the nature of linkage between WSS and poverty reduction. According to the sectoral program, a sustainable improvement in water and sanitation condition is essential to the poor to;

- reduce income losses due to excessive time and energy spent in collecting water;
- increase income earning potential through increase in productivity;
- reduce cost of health services especially for water related diseases such as diarrhea;
- increase income from cattle that depend on water; and
- increase the quality of life of the poor through: Positive impacts on maternal and child health, improvements in school enrollment and attendance, better school sanitation, reduced home duties, drudgery and time spent on water collection especially for girls and women.

Ministry of Water Resources (MWR) (2000:2) also considered the following as the basic benefits that especially women get from water supply scheme:

- time and energy saving as the result of which they participate in other development activities;
- adequate and clean water for cooking and sanitation and hence, better health;
- appropriate type of public points that fit the type of water container they use.

Therefore, the demand for safe, adequate and accessible urban water activities particularly in third world countries has been increasing over-time as a result of the rising standard of living and the population increase resulting from natural growth, as well as rural-urban migration. Under such circumstances planning for water delivery system in both short-run and long-run is critical to ensure that the population receives adequate water supply. It was with this intention that the city's Water and Sewerage Authority in 1999 initiated a program that aims to enhance its own image and position linked with water as an important commercial and social issue in the context of long-term development goals.

2.2. Approaches to water supply

2.2.1. Supply oriented approach

The supply oriented water supply approach focuses on technical elements and monopolistic public service delivery (Mani; 2000:20). This had failed to deliver the required levels of services and adherently resulted in the use of several alternatives to substitute and augment the piped water supply.

It is now realized that the conventional "supply oriented" planning has aggravated the gaps in service delivery. As stated by Mani (2000), supply orientation is found to be:

Economically inefficient, as low-income countries find it impossible to recover the costs of large-scale piped networks, high costs are incurred in pumping and transferring water over long distances and a growing demand is created for more government subsidies. Moreover, piped services are priced well below the full costs of service provision, there by subsidizing the affluent, and leading to chronic budget deficits and dependence on external finance.

Socially inequitable, as certain consumers, generally the poor and low income groups residing in the slums and urban fringe areas, are excluded from the use of these services; and **Environmentally hazardous**, as supply orientation in the water sector stresses the hydrological limits of the region and inflicts environmental costs.

Water supply and sewerage are customarily planned for large, centrally controlled, technology-intensive piped networks with a greater emphasis on production and distribution of water than on maintenance of the system and analogous construction of sewerage facilities. Regarding this, Howe and Dixon in (Mani, 2000:20) identified donor-lender and host country factors as follows:

Donor-lender factors are the bias towards construction, desire to sell available technology and maximize aid flow, failure to provide training for O&M and inadequate budgets for post project evaluation; **host-country factors** are the desire for prestige, opportunities for corruption, lack of inputs from consumers, lack of adequate skills in the construction and operation and maintenance, lack of accountability, inefficient service charging, and shortage of personnel for monitoring.

2.2.2. Demand oriented approach

A demand orientation with a focus on service consumers' needs and willingness to pay (WTP) full costs of services, competitive markets, and broader participation of the private sector, non-governmental organizations (NGOs) and community-based organizations (CBOs) is now being incorporated into water supply and sanitation strategies.

The demand orientation is potentially more economically efficient as demand oriented infrastructure delivery consists of competitive markets, and broader participation of the private sector, or water surrogates. Social responsibility also increases as demand orientation requires greater responsiveness to users' needs and fairness, and participation of the private sector, Non-Governmental Organizations (NGOs) and Community-Based Organizations (CBOs) in service delivery. Environmental degradation is minimized as a demand management in the water sector is valuable in ensuring that a limited supply of water distributed to match the optimal use pattern for the resources.

Mani (2000:21) identified the significant differences between traditional systems of planning service coverage and emerging patterns of service consumption; prevailing

service pricing and expenditure and WTP for services; and mandated institutional arrangements for service delivery and emerging partnerships with NGOs, CBOs, and the private sector. To achieve a demand orientation, these differences need to be bridged. Planning for service coverage can be improved by considering the economic, social, and environmental impacts of heterogeneous consumption along with assessing consumer needs for services.

Service charging must be based on consumption and WTP while discouraging the use of alternatives and incorporating negative externalities on the environment. Partnerships with NGOs, CBOs, and the private sector must be further emphasized through clear definition of roles and responsibilities and mitigation of financial and political risks. A demand orientation can be achieved through policy reform as well as training for changing roles and responsibilities.

2.3. Experience of developing countries

The growing population of most developing countries is disproportional in urban areas. This places considerable pressure on already over burdened budgets to increase the water supply and waste water infrastructure. Moreover, little or no resources are left to supply, let alone, improve rural water supply. To add to the problems, money is spent on studies that would not be implemented. Projects are constructed, but never been implemented (J.Helweg, 2000:1).

As a result, the water supply and sanitation in the developing world is still very inadequate. In Africa for example more than 47 per cent of urban households are without access to safe water. The condition is even worse in rural areas (Grace 2003).

In Nigeria cost estimates and household willingness to pay (WTP) estimates are used to determine what proportion of households would sign-up for each service level at various prices, given the household income (IBID).

Global Water and Sanitation Assessment Report (2000) also estimated that over one-third of the urban water supply in Africa, Latin America and Caribbean and more than that, half of those in Asia, operate intermittently. Intermittent water supply is a significant constraint to the availability of water for hygiene and encourages the low income urban population to turn to alternatives such as water vendors. These water vendors often charge many times more than the formal water tariff for water that often is of doubtful quality and not available in adequate amount.

In India the government also tried to provide water supply based on the demand orientation. The India Infrastructure Report, a recent authoritative document on approaches to infrastructure provision in the country acknowledges the benefits of a demand orientation in infrastructure provision consisting improved assessment of users' needs for the services and demand management. In rural water supply and sanitation, the demand-responsive approach is already being implemented in some parts of the country with elements such as self selection of service types, participation of NGOs, CBOs, and increased participation of women in the community (Mani; 2000:21).

The Swajal project undertaken in Uttar Pradesh state offers the following lessons:

- Cost recovery improves with greater community participation;
- The government is learning to play facilitative and partnership role;
- Weakly formed CBOs are less successful;
- NGOs need time to build effective CBOs;
- Delineating the tasks of NGOs in community organizations and service delivery minimizes the risks and of mutli-stakeholder participation; and
- Integration of water and sanitation services is increasing.

However, in the urban areas, the demand responsive approach has so far been limited to a few programs such as the slum-networking program targeting the poor living in slums and squatter settlements. Mani (2000:22) identified elements of demand orientation from traditional demand estimations as demand estimations are traditionally based on

population levels, current consumption levels, patterns of service consumption, and household characteristics.

Demand projections are made according to past trends of water consumption and population growth. While these give quantitative estimates of the water supply required, other dimensions of demand remain neglected. Therefore, willingness to pay (WTP) and revealed preference studies for new or improved service have been found more useful in demand assessment in spite of the shortcomings of the contingent valuation methods (CVM) upon which they rely.

On top of this, the Organization for Economic Cooperation and Development (OECD) in Mani (2000:22) recommends making greater use of:

- Forecasting future demand for water,
- Appropriate resource pricing for water, and appraisal, reassessment, and transferability of water rights;
- Various non-price demand management measures and integrated administrative arrangements to develop and implement effective water-demand management policies.

According to Munasinghe, demand management can be best achieved through three main mechanisms:

- The selection of a system coverage and service expansion plan to provide consumers with a high level of service that discourages the use of alternative services;
- The setting of a tariff regime to control consumption , distribute social benefits and raise revenue for the sector.
- The education of consumers on water use practices to encourage greater efficiency and productivity in the use of water, and the minimizing of losses (Ibid).

To achieve a demand orientation, service delivery agencies should be urged to be more responsive to users in the nature of services provided, to offer greater financial incentives to various stakeholders involved, and to create an appropriate institutional environment.

2.4. Urban water supply in Ethiopian context

2.4.1. The state of urban water supply in Ethiopia

The water supply and sanitation sector in Ethiopia is one of the least developed and is mostly characterized by service deficiency of physical infrastructure as well as by inadequate management capacity to handle policy and regulatory issue and to plan, operate, and maintain the service.

Regarding this, World Bank Group (2005:2) stated that though Ethiopia is often referred to as the "water tower" of Africa, only a quarter of the country's population have improved access to water sources. Rushing streams from the Ethiopian highlands form tributaries of famous Blue Nile, Tekeze, Awash, Omo, Wabeshebele and Baro-Akobo-rivers which flow across borders to neighboring countries. Six billion cubic meters of water run out of Ethiopia as the Blue Nile River to the Sudan and Egypt. But as recurrent drought drives more and more rural people from their traditional farmlands to urban centers, Ethiopia faces growing urban water crises.

Ethiopia has one of the highest urbanization growth rates in the developing World. According to data obtained from the Central Statistical Authority, the country's urban population was growing at 4.8 per cent per annum between the 1995 to 2000. The urban population in Ethiopia in 1984, the first census period, was 4.3 million forming 11 per cent of the total population. In 1994, the second census period, the urban population was 7.4 million. Total urban population had increased by 12 per cent from that of 1984. Interms of urban centers, in 1984, Ethiopia had 312 urban centers with population of over 2000. In 1994, the second census period, the urban centers in the country grew to 534 registering an increase of 71 per cent over that of 1984 though the definitions of the two censuses are not the same (Tegegne, 2000:2). The growth has been much higher for some intermediate

towns. For instance, Asayaita (6.5%), Assosa (9.9%), Gambella (15%), and Jijiga (9.1%). In 2000 17.6% of Ethiopia's population or about 11 million people live in about 927 cities and towns of different sizes and categories. Currently, in 2005 about 20.1% of urban populations live in cities and towns of different sizes and categories.

The rapid growth of urban population has placed tremendous pressure on the management capacity of municipalities for service delivery and local economic development. This phenomenal growth has also burdened many municipalities with the problems of inadequate housing, poverty and unemployment, inadequate water and electricity supply, and poor sanitation systems.

Available data also indicate that in the next 25 years (1994-2020), nearly 30 per cent of Ethiopia's population will live in cities. This kind of rapid urban population growth will inevitably call for huge investments in housing, urban infrastructure, water and electricity supply, sanitation systems and environmental protection programs and programs to alleviate poverty and unemployment in the cities. This implies that the challenge will require well trained municipal management and resource capacity, responsive urban governance and well trained and motivated personnel and sustaining services such as water, electricity supply, local revenue collection and administration to meet the ever growing demand for better and more quality services and infrastructures. The following table 2.1 intends to provide data on the projected urban population of Ethiopia (1995-2020).

Table 2.1: Urban Population Projection for Ethiopia (1995-2020)

No.	Year	Total population ('000)	Urban population ('000)	% of urban population
1	1995	56677.1	8681	15.3
2	2000	66755.8	11753.6	17.6
3	2005	79368.5	15952.8	20.1
4	2010	94246.0	21400.4	22.7
5	2015	111583.8	20069.2	26.5
6	2020	131485.2	39530.1	30.6

Source: Central statistical Authority; Statistical Abstract, 1997

Because of this population pressure and other factors as per official statistics, coverage of water and sanitation service in Ethiopia is very poor, among the lowest in the world, especially for rural areas. Among the key indicators for International Development Goals, Ethiopia's performance on "sustained" access to safe water sources and sanitation services is one of the worst in the region. Regarding this, Van Dijk (2005:105) stated:

> *In Ethiopia efforts were made to change the situation through decentralization. However, there have not been improvements in water supply and sanitation sector. For instance, Addis Ababa Water Supply Authority's poor performance can be reflected by the fact it can satisfy only 60% of the current demand.*

According to the figures given by Tegegne (2000:16), the amount demanded is much higher than the supply. That is, in 1998 the amount supplied by Addis Ababa Authority was only 62 per cent of the amount demanded. With regard to the distribution of water, the Welfare Monitoring Survey of 1996 estimated that 36 per cent of the households use own tap while 61 per cent use public tap or "Bono Water".

Berhanu and Said in Genenew (1999:8) also figured out that only 27 per cent of the population of Ethiopia have access to safe water and 10 per cent have access to sanitation while these figures stand 71 per cent and 30 per cent for safe water and sanitation respectively for low income countries.

There is also regional variation both in rural and urban areas such as Addis Ababa, Dire Dawa and Harari in particular showing more per centage of population with access to safe source of water and sanitation. Afar, Benishangul-Gumuz and Gambella regions show the low per centage of population with access to safe water. For instance, intowns such as Mekele, Nazareth, Bahirdar and Harrar only 33.6, 38.6, 42.9 and 57.8 per cent of the housing units, respectively, had a private or shared water meter in 1994. The water supply in small towns is extremely low. It is only about 8.6, and 18.12 per cent of the

housing units in Assosa and Gambella respectively that had individual or shared water in 1994 PADACO in Tegegne (2000:16).

Regarding this, the World Bank group (2005:2) mentioned that towns in the 2,000 to 50,000 population range face special challenge in the provision of their WSS services. The demand for differentiated technologies-piped water supply in the core, alternative technologies in the fringe areas- and the often rapid unpredictable water demand and spatial growth require planning, design, and management skills that exceed community based management approaches. But unlike larger towns or cities, these smaller towns often lack the financial and human resources to independently plan, finance, manage and operate their WSS systems. This implies that a key challenge for Town WSS is to allocate limited government resources amongst a large number of dispersed towns. The following table 2.2 reveals the coverage for water supply and sanitation in Ethiopia.

Table 2.2: Coverage for Water Supply and Sanitation in Ethiopia

Region	Per centage of population with access to a 'safe' source of water				Per centage of population with access to sanitation	
	1994		1998		1994	
	Rural	Urban	Rural	Urban	Rural	Urban
Addis Ababa	35.6	98.4	54.6	98.8	5.0	75.0
Dire Daw	23.6	98.1	84.6	99.6	3.0	75.0
Harrari	11.2	98.2	37.7	97.3	1.0	69.0
Benishangul	14.8	55.0	14.1	61.00	15.0	63.0
Gambella	21.3	72.4	21.1	62.4	11.0	31.0
Tigray	10.6	73.9	19.2	96.4	3.0	29.0
SNNPRS	15.5	71.1	21.4	73.8	9.0	63.0
Amhara	15.2	80.2	13.0	85.0	3.0	37.0
Oromia	15.8	76.2	20.0	85.8	7.0	59.0
Semali	9.0	47.9	34.9	98.8	4.0	48.0
Affar	5.2	73.1	16.2	83.0	4.0	37.0
Total	14.8	81.0	18.3	86.0	6.0	57.0

Source: WSP, 2002:3

There are also variations across urban areas. Based on the official statistics, conditions with access to safe water in urban areas is higher interms of coverage, with about 84 per cent having access to safe water sources, though there are some variations across different town size classes. This, however, needs to be treated with caution as most households rely on shared services, consumption levels are very low, seasonal variability is very high and unscheduled disruptions to services are very common. Small towns with less than 2,000 population have access levels of only 40 per cent and those with less than 10,000 population have a level of around 60 per cent. Interestingly, except for the very small 'towns' with less than 2,000 population, most other towns have some form of piped systems, and access to piped systems is over 75 per cent intowns with more than 10,000 population.

MWR (2002:4) distinguished three categories of towns outside Addis Ababa. Rural towns: towns with less than 2,000 population where 60 per cent of towns have piped system, but coverage levels interms of population with access to piped system is low at about 20 per cent. Small towns: towns with 2 to 10,000 population that mostly have piped systems but the access to piped system is only about 50 per cent and medium and large towns all have piped systems but do require some improvement in access. Even among these towns "access" is largely confined to yard taps or shared connections, with the resultant implications for cost recovery and financial viability. The following table 2.3 shows water supply status in urban areas.

Table 2.3: Water Supply Status in Urban Areas, 1994

Population size of towns	Total pop. (in'000)	% of towns with piped system		% of housing units with		
				Individual connection	Piped supply	Safe water
Lessan 2000	349	282	58	2	22	43
2-5,000	1093	338	90	3	43	61
5-10,000	1077	153	98	5	55	69
10-20,000	1192	85	100	10	73	82
20-30,000	754	30	100	13	74	83
30-80,000	1176	26	100	16	76	84
80-250,000	1334	10	100	19	89	94
Addis Ababa	2495	1	100	27	98	98
Total Urban	9470	925	83	15	76	84

Source: WSP, 2002:5

Another key issue in urban areas is the reliability of the water supply. Consultations with the poor also highlighted this aspect vividly. Limited available information suggests that reliability of supply is likely to be quite poor, both interms of quantity and frequency. Regarding access for the poor on the whole, relative level of access to water and sanitation in urban areas is estimated to be high in Ethiopia. However, in some larger urban centers the poor may lack access.

The aforementioned information indicates that as a result of low level of development a significant proportion of the total urban population of Ethiopia in particular and total population of Ethiopia in general have no access to safe and adequate potable water supply. They still restrict themselves to use what nature has provided them with in the form of springs, rivers, lakes, ponds, traditional hand dug wells and rain water which are often unsafe, cause health hazards and are at considerable distance from households.

Among the main reasons given for the slow pace of progress in water supply services in Ethiopia, the following are net worthy: lack of comprehensive legislation; inadequate investment resources; lack of a national water tariff policy and the absence of beneficiary participation and community management (Dessalegn, 1999:12). In relation to this, MWR (2002:13) stated that issues of poor sector capacity and low level of expenditures for WSS are interlinked and lead to a vicious circle – as low level of investments create low demand for technical and manpower inputs in WSS sector, the capacity remains underdeveloped. The resulting low sector capacity, means low allocations and expenditures are curtailed.

The sustainability of water supply facilities mainly depends on a timely and regular maintenance and operation of the system. However, in most developing countries, including Ethiopia, it has been found out that operation and maintenance (O&M) of water supply facilities is in a poor state of condition and the sustainability of the scheme is at stake. Regarding this, MWR (2002:13) identified the following underlying problems:

- Inappropriate tariff setting without emphasis on full cost recovery;

- Lack of clear guidelines for urban tariff setting including issues related to fairness, and financial sustainability;
- Inappropriate or lack of institutional incentives for urban WSPs to achieve financial viability and improved operational performance;
- Poor technical and financial capacity among the urban service providers that leads to high levels of unaccounted for Water (UFW); and
- Poor or non existent consumer services and grievance handling system that leads to a lack of wiling to pay user charges.

According to the feed back gathered from the participants of the workshop conducted in Bahardar in April 1999, the following were pointed out to be the main causes for the O & M problems in Ethiopia in order of importance:

- Poor organizational setup in the sector coupled with the absence of trained manpower;
- Low community awareness regarding the importance of clean water;
- Absence of adequate repair parts, spare parts, and hand tools;
- Financial shortage to support O & M , and the limited funds that are available are used for new installations;
- Low participation of the beneficiaries in the decision making process;
- Substandard designs, poor construction quality, and inappropriate technology;
- Absence of coordinated supervision and monitoring mechanisms;
- Unwillingness to pay for services;
- Low attention paid to local skills and minimal support to Artisans and private sector (Abay Engineering PLC, 2000).

2.4.2. Policy framework

Before 1999, water resources development, in general, and the provision of potable water supply, in particular have been carried out without any policy framework and were not well

coordinated in the country. However, since 1999, it seems due attention has been given by the Ethiopian government to alleviate the problem of access to safe water supply and achieve rapid socioeconomic development through better health care and productivity of its people by formulating the country's water resources management policy in 1999.

The water supply and sanitation policy is an integral part of the country's water management policy. According to the policy document (1999), the policy is believed to provide and impetus for the development of water supply for human and animal consumption. It focuses on increasing the coverage, quantity, reliability and acceptable quality, taking the existing and future realities of the country into consideration. Upon implementation, the policy is expected to achieve the objective of the Ethiopian people to attain adequate, reliable and clean water service that meets the water user's demand.

The policy of supplying free water to any group except for emergency, leads in practice to an unfair situation. Since there are no enough funds to provide such free services, the rural and urban poor are the first to suffer. A better and much more equitable way would be to collect water charges from consumers and then improve and expand the system. Accordingly, the policy envisages supplying improved potable water service for urban areas with tariff structures that are set based on "full cost recovery and self reliance".

Apropos this issue, Alebel (2004) stated that a full cost recovery program has the advantage of providing incentive for proper use; reduces waste and excessive consumption of water resources. Besides, it helps to release funds for other investment programs. The policy considers water as a social and economic good, and it is an integrated one. Full cost recovery requires charging consumers so as to cover the full cost of project construction as well as the operation and maintenance of providing the service. Water development investments by their nature require huge amounts of money.

This implies that charging consumers for water should be done carefully. If prices are set too low, revenues may not be sufficient to cover the full costs of supplying water. If, on the other hand, they are set too high, households may not be able to afford consuming the new

improved water, and again revenues will not be sufficient to cover the full cost. In relation to this, Alebel (2004) suggested that setting the required tariff, information on the ability and willingness of the consumers to pay for such services are essential. In other words, to cover the full costs and sustain the service, revenue should be collected from the sale of the water based on the tariff that considers the full recovery of the cost, on the one hand, and the fairness and willingness of the consumers that are supposed to be served, on the other.

Therefore, the policy for increasing the coverage as the proper use and sustainability of the service requires implementation of a cost recovery system, which can be either full or partial cost recovery. That is, in order to implement the existing policy for the provision of water supply in urban areas of the country fairness of the tariff, willingness to pay for the service and efficient management of the resources of the utility office need to be examined.

2.4.3. Institutional framework and organizational capacity

Although urban water supply services began during the Imperial regime, it was not until 1971 that a body responsible for all aspects of water use and development in the country, the Water Resources Commission, was established. The Awash Valley Authority was set-up in 1962, but its duties were to plan and promote investment activities within the valley. The commission was given a wide mandate and entrusted with the responsibility of planning and utilizing the country's water resources including household consumption. In the early 1980, the government pledged to implement the UN initiated International Drinking Water Supply and Sanitation Decade, which in Ethiopia ran from 1984 to 1994, coinciding with the governments ten year plan, which set an ambitious target for the provision of safe water supply to the rural areas. At the beginning of the 1980, less than 6 per cent of the rural population and 19 per cent of the population in the twenty major towns had access to clean drinking water. At the end of the plan period, the coverage for rural areas was to reach 35 per cent and for the urban areas 85 per cent. While the record of achievement was not as high as planners had hoped for, considerable progress was made in 1980, (Dessalegn, 1999:11).

The Water Supply and Sanitation Authority (WSSA), a division within the Water Resources Commission, was established in 1981. Between then and 1992, WSSA was the principal agency responsible for water development in the rural areas and all urban areas except Addis Ababa. By 1990, a total of 210 urban water systems serving about 3 million people came under WSSA's responsibility. Likewise, the authority was responsible for providing support and maintenance to cover 6000 rural water schemes serving over 4 million people through out the country (Dessalegn, 1999:12).

With the establishment of regional administration under the Transitional Government of Ethiopia in 1992, Water development programmes became decentralized. At present, the Regional administrations are responsible for the development, operation and maintenance of rural and urban water supply systems in their regions. WSSA has also been absorbed into the ministry of water resources and become the Department of Water Supply and Sanitation (DWSS). However, the relationship between DWSS (or MWR) and the regions appear to be unclear and the way decentralization of water development will be carried out in practice needs to be spelt out in more detail.

Within the emerging framework of demand responsive approaches, the role of government is changing from service provision to facilitating and providing an enabling environment. Within the decentralization framework in Ethiopia, different responsibilities are emerging for different levels of government: policy and strategy development, project implementation and monitoring and evaluation. At the federal level the responsibility for the water sector is with the Ministry of Water Resources (MWR). Responsibility for ensuring the provision of these services is with the regions and will eventually be with woredas (MWR 2002:6).

At the regional level, Regional Water Bureaus (RWBs) along with their other responsibilities for water resources are also responsible for water and sanitation. In some of larger regions, woreda water offices with small staff of two persons or so have been established. This trend for the woreda level is intended to be strengthened in the coming years. Within the Ethiopian context, NGOs have been important players in the WSS sector.

For rural water supply schemes (RWS) Ethiopia Social Rehabilitation and Development Fund (ESRDF) has also played a major role in recent years (WSP; 2002:7).

As MWR (2002:7) documented, in Ethiopia, a number of different forms of service providers exist with considerable inter and even intraregional variations, including: Addis Ababa water and sewerage Authority (AAWSA), Urban /Town Service Unit (TWSU), Some Scheme Water Boards (SWB) and at the very local level Water Board (WB) and Village Water and Sanitation Committee (VWSC). There has been limited involvement of the private sector to date, though there is an emerging interest.

With regard to the financing issue, though the National Water Policy envisages financing from domestic financial institutions. So far sector financing has been largely through: budgetary allocations, external debt or grants from bilateral donors and international NGOs, sometimes provided either directly to communities or local levels of government and more recently other off-budget mechanisms such as ESRDF. MWR also proposes to establish a Water Resource Development Fund (WRDF). It is envisaged that the WRDF will pool the government and donor resources and channel in line with the overall sector policy. In the long-run it is visualized that WRDF will also mobilize additional resources (MWR, 2002:9).

With decentralization, a large share of federal resources is transferred to regional governments and regional and woreda governments allocate funds for the WSS sector from their own budgets. However, an effective decentralization process is constrained by: the lack of medium term federal subsidy estimates and donor practices that inhibit multi-year planning. WSS allocations within this emerging decentralization framework depend on the planning process at these levels and the issue of relative preparedness of the WSS sector at this level will be an important determinant (ibid).

Based on available information, preliminary and indicative estimates suggest that the current level of funding allocation to the sector is about 34 million USD per annum. Clearly, to achieve improvements in poverty reduction and other development goals

water supply and sanitation deserves an equal attention as other sectors such as education, health and roads. However, WSS allocations leave a great deal to be desired as compare to these sectors. This more likely reflects a lack of sector readiness to absorb resources rather than a low priority for water supply and sanitation. The priority actions and programs with in the sector will have to focus on strengthening overall sector capacity along with the specific investment strategies linked to coverage targets. (MWR; 2002:10).

From this review of related literature we would understand the pertinence of and the different approaches to urban water supply. In the next chapter we try to see the physical, demographic and socio-economic condition of Assosa town and observe the level of infrastructural facilities.

CHAPTER THREE

3. Description of the Study Area

3.1. The Region

Benishangul Gumuz Regional State (BGRS) was established in 1994 by the constitution of the Federal Democratic Republic of Ethiopia. It is one of the constituent regional states created for the Federal system of governance (BoFED, 2003:1).

BGRS is located in the Western part of the country. It stretches along the Sudanese border between 09.17 and 12.06^0 N. The Western and Eastern limits are given by longitudes 34.10^0 and 37.04^0 E respectively. The Amhara, Oromia and Gambella Regional states are bordering the region in the North, East and South, respectively.

The total area of the region is estimated to be about 50,380 km^2. The region is divided by the Blue Nile into two parts. The Northern part which encompasses Metekel Zone and pawe special Woreda comprises an area of 26,560 km^2, the Southern part Assosa Zone, Kemashi Zone and Mao-Komo special woreda constitutes 23,820 km^2.

The Region is administratively divided into three Zones, eighteen woredas and two special woredas. The three Zones are setup to create a link between the region and the woredas, which by constitution have council. (See the Map of the region from the annex).

The region has potentially rich surface and subsurface water resources. However, little was done to utilize these resources. In 1997 it was only 19 per cent of the population that got potable water whereas this rose to 29.11 per cent and 34.21 per cent in 2002 and 2003, respectively. It also rose to 35.48 per cent in 2004 (see the table, below).

Table 3.1: Coverage of Drinking Water Supply in BGRS, June, 2004

No	Woreda	Population			Beneficiary of potable water			Per centage of Beneficiary
		Urban	Rural	Total	Urban	Rural	Total	
1	Pawi special woreda	8174	38,137	46,311	-	500	500	1.08
2	Maokomo special woreda	-	17,720	17,720	500	2,250	2,750	15.52
3	Dangur	4,784	34,615	39,399	5,000	3,600	8,600	21.83
4	Guba	1,068	9,108	10,176	300	4,200	4,500	44.22
5	Wombera	3,573	49,435	53,008	500	4,200	4,700	8.87
6	Mandura	2,128	26,624	28,752	2,500	3,900	6,400	22.26
7	Debate	4,281	48,679	52,960	3,000	11,974	14,974	28.27
8	Bullen	4,794	22,472	27,266	-	6,700	6,700	24.57
9	Menge	272	36,356	36,628	1,000	7,577	8,577	23,42
10	Kurmuk	474	12,982	13,456	2,000	8,433	10,433	77.53
11	Assosa	17,278	78,042	95,320	8,000	70,923	78,923	82.80
12	Sherkole	-	17,679	17,679	500	2,850	3,350	18.95
13	Bambasi	6,117	38,101	44,218	-	26,930	26,930	60.90
14	Oda Buldeglu	-	28,208	28,208	500	3,197	3,697	13.11
15	Komosha	-	12,339	12,339	3,000	5,490	8,490	68.81
16	Yaso	-	9,784	9,784	1,000	5,000	1,500	15.33
17	Serbaabay	-	10,495	10,495	500	3,050	3,550	33.83
18	Kamash	-	11,609	11,609	3,300	2,960	6,260	53.92
19	Agalomete	-	17,872	17.872	500	3,050	3550	28.55
20	Belogeganfoy	-	14,186	14,186	1,000	3,050	4,050	28.55
	Total	52,943	534,442	587,387	33,100	175,334	208,434	35.48

Source: BGRS Water, Mines and Energy Resource Development Bureau, Drinking Water Supply Coverage (1997-2004), Page 1.

When we compare the whole woredas, Assosa stands first followed by Bambasi and Komosha. Other woredas Pawi, Wombera and Oda Buldiglu have the lowest number of beneficiaries of potable water in the region. i.e. only 1.08, 8.87 and 13.11 per cent, respectively. This implies there is high gap between woredas of the region interms of access to potable water.

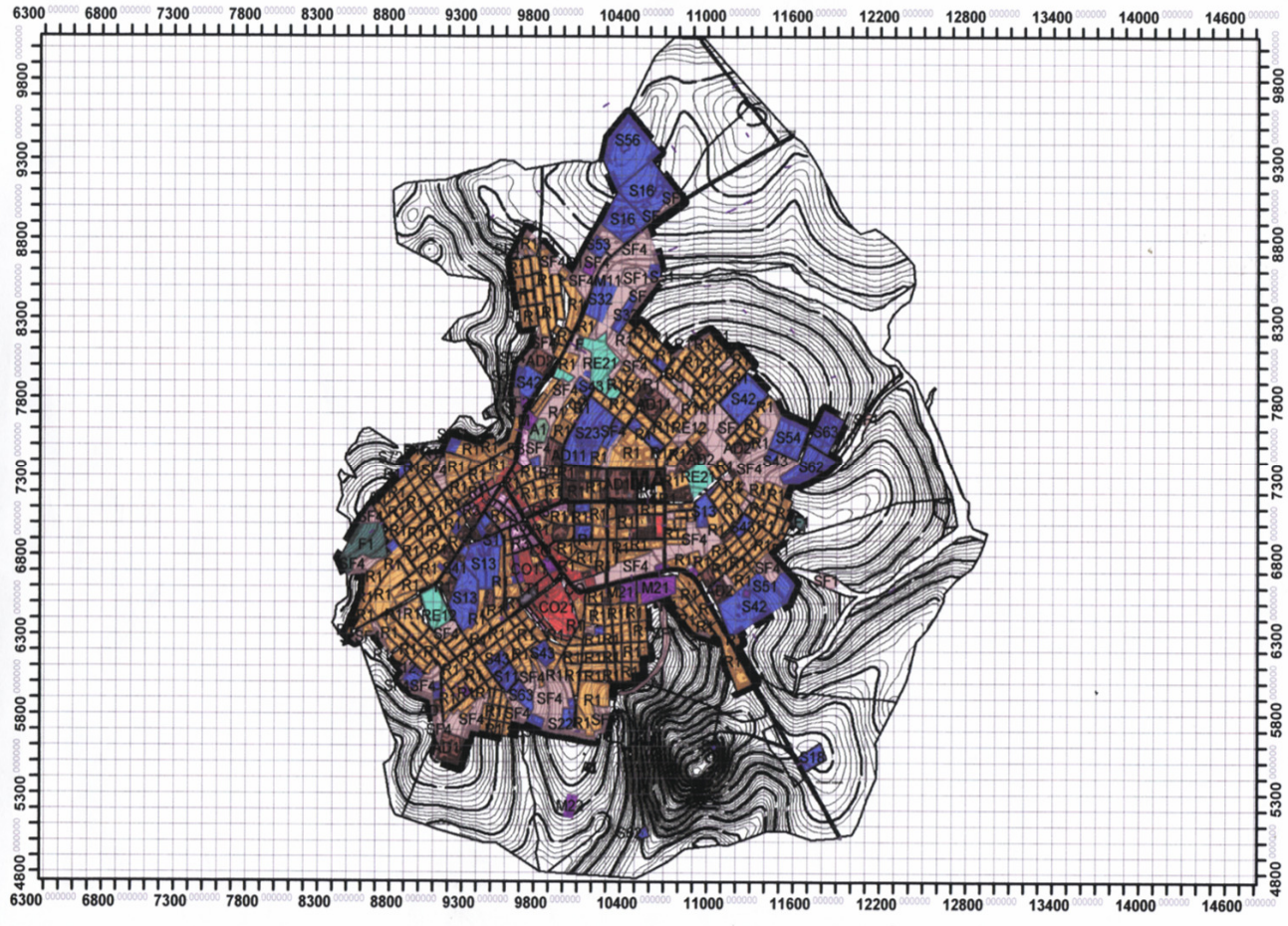
3.2. Assosa town

3.2.1. Physical characteristics

Assosa has been said to had been established at the turn of the 20th century. It has not shown any significant growth since its establishment. Relatively fast growth and/or development of the town were witnessed during the Italian occupation (1936-41) and the Derg Regime (1974-1991). Besides, the resettlement programs that were carried out between 1979 and 1985 had accelerated the growth of the town. However, the town witnessed an abrupt decline during the last years of the Derg Regime and during the first two years of the transition period (NUPI, 1995).

The first master plan of Assosa, prepared by the Ministry of Urban Development and Housing in 1979 had served in guiding the development of the town until it became obsolete in 1993. Thus a new development plan is intended to be studied for Assosa town in 1993/94 budget year and started in 1994. Now the town has a master plan developed in 1995. The kebeles are the smallest administrative units under the municipality (see the following city plan of Assosa).

Existing City Plan/ Map of Assosa



Existing Land Use of Assosa/ Legend:

Existing Residence	Manufacturing and Storage
Commerce	Recreation
Administration	Forest and Informal Green
Service	Special Function

Source: Federal Urban Planning Institute (FUPI) ,2006.

Assosa town is the capital of Benishangul Gumuz Regional State (BGRS), which is one of the nine regional states comprising the Ethiopian federal structure. According to information obtained from municipality of the town, Assosa is a town founded in 1984. It is located at the South Western part of the country, 678 km away from Addis Ababa.

So, the town could be taken as one of the border towns in the country. It is located at 90 km away from the Ethio-Sudanese border. About 335 km of the road is asphalt (i.e., up to Nekemte) while the remaining 343 km is all weather gravel road. It is situated on a flat plane at an average altitude of 1,645 masl (MWR, 2001). Astronomically, the town is located between $10^{0}00^{1}$ and $10^{0}03^{1}$ North and between $34^{0}35^{1}$ to $34^{0}39^{1}$ East. It lies on an area of about 982.5 ha. It is surrounded by resettlement villages: in the North by Amba 8 and Amba 3, in the East by Amba 4 and in the South by Amba 38 (National Urban Planning Institute, 1995: 12).

Assosa town is located in the 'Kola' climatic zone. It has mean maximum and minimum temperatures of 33.7^{0}c and 11.6^{0}c respectively. The maximum temperature varies between 23.8^{0}c to 33.7^{0}c. While the minimum shuttles between 11.6^{0}c to 19.0^{0}c. The maximum temperature occurs in February. (See table 3.3, below). The mean annual rainfall is about 991.5mm. The rainy season extends from April to November, but the maximum rainfall occurs in summer season (i.e., between June and August).

Table 3.2: Mean Monthly Rainfall and Temperature at Assosa Town.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Maximum Temp. (^{0}c)	30.3	33.7	22.9	32.4	29.1	25.3	23.8	24.8	25.2	25.9	28.5	30.5
Mean Minimum Temp. (^{0}c}	12.6	16.6	15.9	19.0	17.8	16.1	15.6	15.7	15.7	14.2	11.6	12.4
RF. (mm)	0.0	0.0	9.0	18.8	100.7	169.5	218.6	146.6	146.6	163.7	0.0	0.0

Source: BGR Meteorological Stations Branch office, 2005, Assosa.

The characteristic of the vegetation is the reflection of climate. Thus, the vegetation of the town and its surroundings mainly consists of woodland and savanna. They are mixed deciduous woodlands and savanna with various types of acacia. Most of the trees are deciduous that shed their leaves during the dry season.

Although there are different types of trees in the town, the dominant species is Mango tree. The Mango tree gives dual purposes: giving shade to the town on the one hand and edible Mango fruits on the other. The other types of trees growing in the town include eucalyptus, Neam and Papaya.

Despite the location of the town in the hot climate, temperature is relatively cool because of the good vegetation cover (trees) which has a moderating effect. In fact, the researcher observed that the best tree to create cool temperature is the Neam tree under its shade. The tree is well adaptable to and grows fast in places with hot climatic conditions. It is worth mentioning that all the trees in the town have been planted by individuals inside their compounds and there are no trees along roadsides that could provide shade for pedestrians.

3.2.2. Demographic characteristics

The population growth rate is estimated to be 3.2 per cent and 3.5 per cent per annum in the urban and rural areas respectively (CSA, 1994). Urban population growth is primarily caused by migration from other regions and resettlement in the sparsely populated areas of the region. The following table 3.3 provides the population distribution of urban centers in Benishangul Gumuz, 1994.

Table 3.3: Population Distribution and Per centage of Urban Population by Urban Centers of BGRS, 1994

Town	**Urban Population**	**Per centage of urban Population to the total population of the woreda**
Manbuk	3253	9.02
Debrezeit	2429	6.74
Genete Mariam	1148	4.02
Debate	2912	8.09
Bullen	3264	9.06
Assosa	11,749	32.6
Bambasi	4,164	11.56
Almu (pawi)	5572	15.48
Total	**34,491**	

Source: BGRS Office of Population, Excluding Small Woreda Administrative Centers.

As presented in table 3.3 Assosa town constitute the highest urban population (32.6 per cent) followed by Pawi (15.5 per cent) and Bambasi (11.6 per cent). Nearly three towns constitute 60 per cent of the overall population of the region. The least populous towns are Debrezeit (6.74 per cent) and Genete Mariam (4.02 per cent).

As indicated in the above table the population of Assosa is higher than other urban centers of the region. One of the main causes for the growth of population has been rural-urban migration which was caused by the increase in the status of the town over time. For instance, before 1988 it was a woreda capital, between 1998 and 1994 it was an administrative regional capital and since 1994 it has been a capital of Benishangul Gumuz Region. In addition to this, there had been rural settlement programs carried out in the surrounding areas of the town between the years 1979 and 1985 (NUPI, 1995:27). This settlement might have probably made the rural-urban migration rate high thus contributing much to the high growth of the population. The following table 3.4 shows population of Assosa town by migration status.

Table 3.4: Population of Assosa Town by Migration Status

	None migrants	**Migrants**	**Not stated**	**Total**
Both	3906	7591	202	11,749
Male	1868	4292	114	6324
Female	2038	3299	88	5425

Source: Population and Housing Census for BGRS, 1994

The Central Statistical Authority (CSA) conducted a national census in 1994 and reported the number of population of Assosa town was 11,749. The town's population increased from 11,749 in 1994 to 14,701 in 2000. The rate of population growth has been increasing faster since 1998 and has been growing at the rate of 4.07 per cent. The projected population size of Assosa town also shows 16,312 figures in 2000. The town's population increased from 16,312 to 20,226 in 2005. The rate of population growth rapidly increased in 2004 to 5.4 per cent. The average rate of growth is 4.38 per cent. This growth can be attributed to Assosa's increasing importance as the economic and

political of the regional state and the subsequent migration from the neighboring regions. Table 3.5, below provides data on the growth of population of Assosa town between 2000 and 2005.

Table 3.5: Projected Population of Assosa Town

No.	Year	Growth Rate	Projected population
1	2000	-	16312
2	2001	4.0	16964
3	2002	3.8	17616
4	2003	3.7	18268
5	2004	5.4	19255
6	2005	5.0	20226

Source: Central Statistical Agency, statistical Abstract, 2000-2005

According to the information obtained from the kebele Administrations in the town, the population of Assosa town in 2005 was 20,460. This figure is higher by about 8,711 as compared to the census population of Assosa town, the 1994 CSA census, 11,749. The Kebele's estimate is less reliable than that of the CSA census because the 'Kebeles" may not follow standard procedures in taking statistical information.

According to the Bureau of Works and Urban Development and the 'Kebele' Administrative office data documented in 2000 and 2005 respectively, the population distribution in the four kebeles of the town are depicted in table 3.6, below.

Table 3.6: Population Distribution in Assosa Town by Kebeles

Year	Kebele				
	01	02	03	04	Total
2000*	4962	5267	4573	3149	17951
2005**	5530	5175	5510	4245	20460

Source: * Benishangul Gumuz Bureau of Works and Urban Development,

** kebele Administrative Data.

The reason for such a high growth rate could be due to influx of people to the town from the near by settlement areas in seeking safety during the change of government in 1991 and the civil unrest between 1989 to 1991.

3.2.3. Socio-economic characteristics

According to a number of socio-economic indicators and parameters services and infrastructural facilities in Assoa town are far below the level of the actual requirements. Because of its remote location, 678 kms away from Addis Ababa, it lags behind many other federal regions in economic and infrastructural development, including severe shortage of trained personnel in development management, in adequate provision of roads, educational and health facilities and low level socio-economic development.

In Assosa town the major economic activities are mainly related to selling and buying agricultural products and retail trade of consumable goods. Economic activity related to traditional gold mining is also important.
At present there is no major type of industry in Assosa apart from privately owned small oil mills and metal and wood workshops. In the future, due to good potential of the area in the agricultural sector, it is anticipated that the agro-industry such as flour mill and edible oil mills could be developed. Moreover, due to good potential of the area in the mining sector, it is expected that large scale mining, such as gold mining could be further developed.

The commercial activity in Assosa is mainly concentrated in retail trade of goods which are carried in shops and at the two open market areas. There is one government owned Bank, the commercial Bank of Ethiopia. There are also hotels, restaurants, bars and jewelry shops in the various parts of the town.

As stated in the above chapter, Assosa town is the capital seat of BGRS and has high population growth caused by rural-urban migration, resettlement of sparsely populated areas and natural increase. A number of socio-economic indicators showed that services

and socio-economic facilities are far below the level of the actual requirements. Thus in the following chapter the water sources, types of water supply system, its distribution, coverage, tariff setting and further demand is assessed.

Chapter Four: Results and discussions

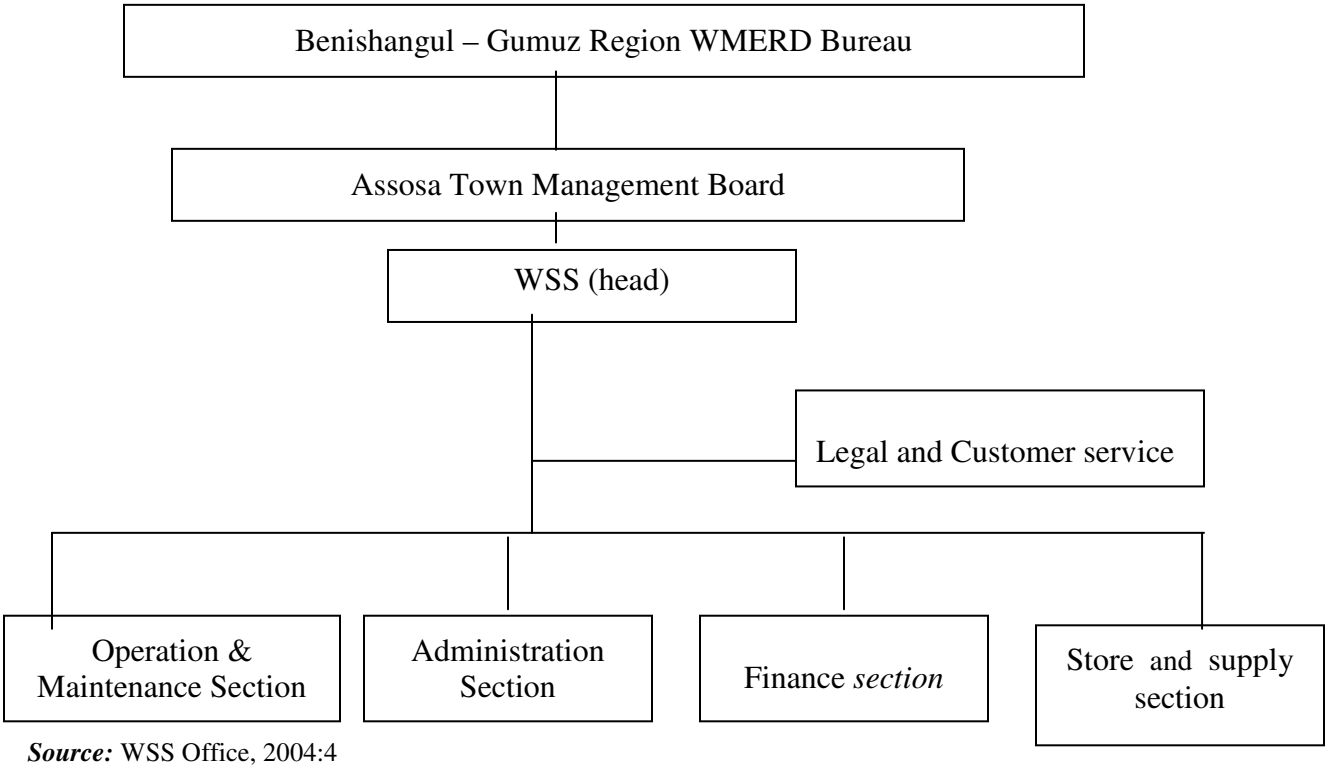
4.1. Institutional framework and capacity

4.1.1. Institutional set up of WSS office

The urban water supply and sewerage service of Assosa town is the responsible government organ for the delivery of water supply service. Not only the organizational capacity of WSS office but also the capacity of the Municipality of the town is an important factor in bringing about remarkable revamp in the area under discussion. However, the municipality did not involve in water supply activities except the head of office who served as Board member and technical leader of the extension of pipelines in accordance with Master Plan of the town. The sustainability of the water supply scheme is mainly dependent on the effectiveness of management unit to operate, manage and maintain the implemented scheme.

The Assosa Water Supply and Sewerage Service Office (WSS) is responsible for the operation, maintenance and management of the already constructed water supply structures of the town. The scheme is of course demand responsive and hence the benefiting community should have a great role in all matters of the project. In 2002 the Water Management Board that can represent the community and enhance community's participation was setup. The Water Management Board comprises two community representative members, the Municipality head, Water Resources Mines and Energy Bureau head and head of Water Supply and Sewerage Service Office. The chart below depicts organizational structure of WSS office of Assosa town.

Chart 1: Organizational Structure of Assosa Town WSS



Source: WSS Office, 2004:4

The WSS office located in Assosa town administers the Assosa water supply scheme and reports to the management Board. The WSS office is responsible for operation, maintenance, and management of WSS of Assosa town. The WSS office does all maintenance work except for the major ones that need special tools and skills. For the major maintenance work, the WSS reports to the regional WMERD bureau, i.e., technical support only.

The sustainability of water supply facilities mainly depends on operation and maintenance (O & M) of the system. However, it has been found that O & M of facilities are in a poor state of condition and hence the sustainability of the scheme will be at stake.

In relation to this, the following adverse conditions were identified as problems related to O & M functions of WSS office.

- Lack of spare parts;
- Absence of laboratory equipment;
- Lack of trained personnel who fully understand how to operate the systems;
- Poor financial management and paucity and
- Inadequate planning are the main ones.

WSS offices of Assosa town faced sever management and personnel capacity constraints for sustaining and delivering water supply. Salaries and incentives are very poor and not competitive with market wages and benefits. This implies that the WSS office neither attracts nor retains competent personnel to serve the community better. The table below presents the general personnel profile of WSS office of Assosa town, in 2004.

As it can be observed from the table 4.1, Assosa town WSS office has insufficient and unqualified personnel for effective management and governance. There are only 41 permanent employees most of whom do not have appropriate education and training in water supply service delivery. Six of the job positions in the WSS office of Assosa town are vacant. The vacant positions include the head of WSS office and other expertise positions. This implies that organization which is led by delegated personnel lacks accountability and responsibility which leads to inefficient service delivery.

Table 4.1: Personnel Profile of WSS Office of Assosa Town, 2005

No.	Position	Approved position	Occupied position	Vacant
1	Head WSS office	1	-	1
2	Head Administration Department	1	1	-
3	Head Accounts and Budget	1	1	-
4	Head operation and maintenance section	1	-	1
5	Typist	1	1	-
6	Store keeper	1	1	-
7	Accounts and budget worker	1	-	1
8	Purchaser	1	1	-
9	Bill collector	1	1	-
10	Water fees collector	1	1	-
11	Cashier	1	1	-
12	Record and documentation	1	1	-
13	Guard	18	15	3
14	Messenger	1	1	-
15	Driver	1	1	-
16	Cleaner	1	1	-
17	Water operator	2	2	-
18	Motor operator	6	6	-
19	Plumber Forman	3	3	-
20	Water seller	3	3	-
		47	**41**	**6**

Source: Assosa Water Supply and Sewerage Service Office (WSS), 2005.

4.1.2. Financial capacity of municipality and WSS office

The challenge for the town of Assosa in effective service delivery is the shortage of revenue to curtail its recurrent dearth of expenditure and finance essential public services and facilities. Municipal revenue is the means that oils urban operations. The municipality of the town has the duty to raise adequate revenue and finance basic services for its urban in habitants. However, lack of the necessary financial resources has always been an impeding factor. The important revenue source of the municipality for financing urban development projects is the revenue generated from different local sources including local taxes and service charges. The detail of local revenue sources, their share and the revenue generated between 1998/9-2003/04 are presented in Table 4.2 below. It is apparent from Table 4.2 that there are only two forms of local revenue sources: local taxes and service charges.

Table 4.2.: Assosa Municipality 1998-2003/04 Budget Year Revenue Collected

Sr/ No.	Source of Revenue	1998/9	1999/00	2000/01	2001/02	2002/03	2003/04	1998/9 _ 2003/04 Average Revenue	% Share
1	Business tax	8985.55	5910.75	10153.00	950.00	150.00	-	4358.2	0.25
2	Market place tax	1753	1742	2972	3658	3948	6638	3451.8	0.20
3	Livestock market tax	2805	5370	4168	14921	25286	22296.30	12474.4	0.73
4	Sanitation service fee	949	9399.25	-	-	210	940	1916.4	0.11
5	Soil tax	48831.74	39916.33	65236.62	45391.04	79240.99	175486.19	454102.9	26.5
6	Registration of Agreements	30181.93	27595.34	22020.38	17732.04	14246.74	21371.77	133148.2	7.8
7	Vehicles road tax	20064.03	13703.06	29900.65	24868.51	32164.77	60053.07	180754.4	10.6
8	Abattoir service fee	4611	2444	5200	10267	9534	16352	48408	2.8
9	Technical service fees	25958.55	372994.40	25192.81	34666.42	85600.35	96895.85	305608.4	17.9
10	Urban land rent	55845.60	29005.40	62459.91	107856.76	120618.59	128984.01	504770.3	29.5
11	Subsidy	50,000	-	-	-	-	-	8333.3	0.49
12	Miscellaneous	-	-	-	4351.68	10540.96	3671.69	4760.7	0.28
13	Sale of targa	-	-	-	2360.-	3425	5485	1878.3	0.11
14	Credit of salary	-	-	-	-	545.58	-	90.93	0.005
15	Contractors	-	-	-	-	1846.66	279381	46871.2	2.7
16	Fuels and oils						2727	453.8	0.003
	Total	249985.40	17.380.53	227309.37	267022.45	387357.64	553690.69	1711381.2	100

Source: Assosa Muncipality

As a form of property tax, Assosa municipality used to collect land rent and building taxes as per legal notice No. 64/79. Recently, this proclamation has been replaced by Regulation No.1/2000 of the urban land rent regulation but this has not been made operational, i.e., no revenue has been secured as expected because of lack of professional accounting and finance personnel.

Regarding the municipal per capita revenue and expenditure, the data obtained from Assosa municipality indicates that the average municipal per capita income of the town is 1.8 US Dollars (1998-2003) whereas the annual municipal per capita expenditure is 1.2 US Dollars (1997-2001). Both figures are by far lower than the average for African cities. Such very low per capita municipal income indicates that the municipality of Assosa is not able to supply adequate basic services to the people. Table 4.3 below depicts this reality. Expenditure of Assosa municipality is indicated in annex 17.

Table 4.3.: Assosa Municipality Average Per Capita Income and Expenditure (in US Dollar).

No.	Description	Average per Capita Income	Average per Capita Expenditure
1	Assosa	$ 1.8	$1.2
2	Africa	$ 15.20	$10.23
3	Transition	$ 237.00	$77.40

Source: Urban Indicators survey habitat, April, 1997:19 and Assosa Municipality 2004

- Transition: Countries in transition (newly emerging or industrialized countries).

Revenue collection efficiency of Assosa municipality is also measured by comparing the actual revenue collected with the revenue to be solicited. The table 4.4 below reveals comparison of estimated and actual revenue of Assosa municipality (1998/9-2003/04).

Table 4.4: Comparison of Estimated and Actual Revenue of Assosa Municipality (1998/9-2003/04)

Sr/ No.	Budget Year	Planned	Actually Collected	Difference
1	1998/9	318,800.00	249,985.40	(68,814.6)
2	1999/00	409,500.00	172,380.53	(2,371,19.47)
3	2000/01	596,048.61	227,308.37	(368,740.24)
4	2001/02	498,816.13	267,022.45	(231,793.68)
5	2002/03	993,358.00	387,357.64	(606,000.36)
6	2003/04	1,218,400.00	550,181.42	(668,218.98)
	Total	4,034,922.74	1,854,235.81	(2,180,686.93)

Source: Assosa municipality

As table 4.4 above shows, the revenue collection efficiency of Assosa municipality has been erratic. The total planned local revenue between 1998/91-2003/04 was 4,034,922.74 Ethiopian Birr out of which the actual collection was only 1,854,235.81 Ethiopian Birr, only 46 per cent. This gives a variance of 2,180,686.93 or 54 per cent of the planned revenue. On the other hand, the average revenue collection efficiency of the municipality for the six years was estimated at 309,039.30 per annum, which is inadequate to finance basic municipal services. This clearly indicates that the municipality has inherent management and organizational problems to collect its potential revenues. Moreover, the high gap between plan and actual performance emanated from over ambitious planning without considering the existing realities of the organization. The plan did not consider the prevailing revenue base/ source, its organizational capacity interms of skilled man power, budget and other inputs that can help achieve the desired goal of revenue collection according to the plan. The following main factors are identified for the low level of revenue and income of the municipality:

- Narrow revenue base;
- Poor revenue collection efficiency due to lack of trained personnel;
- Low and inelastic revenue tariff;

- Absence of taxable establishments/ sources, except few small business activities in the town; and
- Absence of appropriate financial rules and procedures that can aid efficient revenue collection and administration.

The other challenge for the town's ineffective water supply service delivery and inability to expand the service coverage is shortage of revenue of the WSS office to cover its recurrent expenditure shortfall and finance the expansion of piped water facilities. Revenue is the means that facilitates water supply operations and maintenance and expansion of new establishments. The WSS office of Assosa town has the duty to raise adequate revenue and finance water supply services for its urban inhabitants. However, lack of financial and then that of material equipments, spare parts and machines has been an impeding factor. The important revenue source of WSS office for financing water supply service is the revenue generated from water sales and meter rent including service charges (See table 4.5, below).

Table 4.5: Own Revenue of WSS office of Assosa Town by Source (2001-2005)

Description	Year					2001-2005 Average Revenue
	2001	2002	2003	2004	2005	
Water Sales						
Public water points	15,473.51	16,179.37	17,734.55	15,943.95	12,201.96	15,506.47
House connections	39,178.29	41,271.17	47,649.75	42,348.10	127,500.62	59,589.86
Other connection	94,576.75	119,769.89	126,281.95	101,049.8	178,402.49	124,016.18
Meter pent	10,818.00	9549	13,394.00	13,301.00	30,735.75	15,559.6
New connections	2,687.00	9,440.73	21,165.80	19,846.64	39,410.40	18,510.11
Service charges	4,060.00	8,232.00	49,398.22	51,400.63	107,001.91	40,018.6
Grant income	1,280.00	2,215.00	2,225.00	3,260.00	6,780.55	3,137.71
Other incomes	1,275.57	919.92	1,784.12	6,093.72	1,546.48	2,323.96
Cattle water feeding	-	-	-	-	-	-
Understated amount	-	-	308.24	-	-	61.64
Total	**169,349.12**	**207,577.08**	**283,941.63**	**253,243.84**	**503,508.46**	**282,724.13**

Source: Assosa Town WSS Office

From the table 4.5, above, it can be observed that the revenue collected from public water points increased from 2001 to 2004 and declined in the year 2005, the average being 15,506.47. Revenue collected from house connections increased from 39,178.29 in the year 2001 to 127,500.62 in the year 2005, the average being 59,589.86. Revenue from service charges increased from 4,060.00 in the year 2001 to 107,001.91 in the year 2005, the average being 40,018.6. The highest revenue is, of course, collected from non-domestic use (other connections), the average being 124,016.18. However, the total average revenue collected between 2001- 2005 is Birr 282,724.13 only which is minimal even to cover its recurrent expenditure and operation and maintenance costs of the service delivery. This implies that we cannot expect expansion of the service coverage by WSS office of Assosa town alone. The comparison of revenue collected and expenditure incurred is also presented in the table 4.6, below.

Table 4.6: Revenue - Expenditure Per centage Gap of WSS Office of the Assosa Town (2001-2005).

Budget Year	Revenue	Expenditure	Revenue-expenditure per centage gap
2001	169,349.12	249,129.97	-0.47
2002	207,577.08	196,220.23	0.05
2003	283,941.63	260,136.92	1.09
2004	253,243.84	259,180.43	-0.02
2005	503,508.46	430,831.80	0.14
Total	**1,417,620.13**	**1,395,499.9**	**0.79**

Source: WSS office of Assosa town.

The data indicates that total revenue expenditure per centage gap of the WSS office of Assosa town is 0.79. The gap is also understated for the years 2001 and 2004. This implies the WSS office of Assosa town has lack of finance to supply adequate water supply services and also to augment or expand the new establishments for its urban inhabitants.

4.2. Survey analysis

4.2.1. Characteristics of sample households

Out of the total of 196 respondents that have been interviewed in the survey, 88 per cent (173) and 12 per cent (23) were males and females respectively. Average household size of the sample households is 4.06 ranging from 1 to 10. The average household age in the sample household is 37.2 years and ranges from 20 to 73. With reference to their educational level, 8.1 per cent are illiterate 5.6 and 17.3 per cent are those completed their first and second cycle education respectively. 7.7 and 10.7 per cent are high school graduates. Those who have certificate and diploma constitute 30.6 per cent and those who have first degrees and above constitute 13.3 per cent. The remaining 6.6 per cent are non respondents (see annex 6).

The sample households have different occupations. These include government employees, trade businessmen, daily laborers, farmers and others (pensioners and households that depend on other people for their survival). Out of the total of 196 sample households 59.2 per cent are government employees for they constitute the dominant section of the town's population. Business men constitute 12.2 per cent whereas 8.9 per cent of the sample household is daily laborer. The remaining 5.1 and 4.6 per cent are farmers and others respectively (see annex 5).

Regarding income of the sample households, the average household income is 1,488 Br ranging from 50 to 3,000 Br. Out of these 55.1 per cent of the sample households have income below the average while 10.2 per cent have above the average. The remaining 34.7 per cent were not willing to reveal their income. The high level of average income is owing to high extreme value that affected the average, i.e. Birr 3,000.

The sample households consume water from private connection and incur averagely Birr 14.6 for their water expenses monthly since they consume averagely 4 jericans per day or 25l/d/c and pay the price set by the Board which is a progressive rate. The households using water from public fountain also incur averagely Birr 9 for their water expenses

monthly since they consume averagely 3 jericans per day or 15l/d/c and pay the price set by the Board (0.1Br), which is flat rate for all consumers, assuming that the households do not consume water from vendors. However, when they consume from water vendors the minimum price for traditional hand dug well is 0.20, from private meter connection is 0.30 and from those who sell collecting water from river by donkey is 0.50, the average being 0.30 per Jerican. This raised the expense for those who use 4 jericans per day to 18.74 Br given the fact that interruption of water occurs two days per week resulting in rise of consumers of public water points to Birr 16.2, the difference being Birr 4.1 and 7.2 respectively per month. Thus, the alternative sources should be developed to overcome this problem. The options that might be set include: spring development at different directions of the town, protecting river water from contamination such as fencing the river water collecting points, chlorinating traditional hand dug wells, promoting the advantage of containers during unexpected interruption etc. among other options that can be set.

The results of house ownership were that 50.5 per cent of the surveyed households reside in their own houses whereas 48.5 per cent live in rented houses. The remaining 1 per cent were not willing to say whether they own or rent their dwellings. Those living in rented flats have rented either government or private ones. Out of the total sample households, 19.4 per cent have bathing room in their houses while 78 per cent do not have bathing rooms in their houses and take bath either from rivers, springs or by drawing water from the traditional hand dug well.

Out of the total sample households 94.9 per cent have toilet facilities among which 5.6 per cent is flush toilets and 90.8 is pit latrines. 4.08 per cent have neither flush nor pit latrine, and use either in group toilets or open fields or river courses. In areas where there is shortage of water supply and frequent interruption, pit latrine is the preferable toilet facility than the flush toilet of the modern technology. This is because of the fact that pit-latrine does not need water after defection. In addition to this, they can easily be constructed by the low income communities. However they should be spaced at the

reasonable distance from traditional hand dug wells and other water sources in order to protect contamination.

Most of the sample households in the town do not have waste disposal system. Out of the total 196 households 53.6 per cent do not have solid waste disposal system and dispose their solid waste either in their compounds, near to roadsides or on open fields. In addition to this, 81.6 per cent of the sample households do not have liquid waste disposal system and also dispose their liquid waste either on street or in their compound.

4.2.2. The state of existing water supply in Assosa town

4.2.2.1. Water sources

The existing source of water supply for Assosa town is ground water. A total of seven potential boreholes have been drilled within the town at different times. The Ethiopian Water Works Construction Authority drilled four of the boreholes named as BH1, Bh2, BH3, and Bh4 in between 1983-1985. At present all of the boreholes are not used as a water source for the Assosa town due to failure of the submersible pumps installed in the two boreholes, one dried and siltation of the fourth borehole. The fifth borehole named as Bh5 located adjacent to the hospital was drilled in 1996 by the Water Well Drilling Agency. This borehole is 60 m. deep and operates for 11 hours per day with operating yield of 3l/s.

Additional 3 boreholes were drilled by Immediate Rehabilitation and Extension Programme. Two of them are at Hoha well field and so named as Hoha No.1 boreholes. These boreholes have operating yield of 4.8l/s and works for 7 hours per day. The remaining one borehole is drilled by the same programme around 'Timkete Bahar' and named as Borehole No.6. This Borehole has operating yield of 4.72l/s and works for 13 hours/day. These boreholes drilled by the Immediate Rehabilitation and Extension Programme became operational in 2004. Thus, the source of water for Assosa town is from these four boreholes out of seven potential boreholes drilled at different times.

4.2.2.2. Production

The current production of water depends on 4 boreholes, all of which are integrated to one water supply system and are administrated by Assosa town Water Supply and Sewerage Service Office. The gross water production capacity of these boreholes is 12.52 litters per second (l/s) or 540,864 l/day (540.86m3/day).

However, the actual production of water has been lower than the maximum capacity mentioned above, because the boreholes do not work for 12 hours /day without break. Considerable discrepancies have been observed between actual water production and the expected yield.

It was observed that the boreholes produce under their capacity. Production data computed for 4 boreholes showed that total actual production of water from these wells accounted for 85.2 per cent of their capacity (540,864l/d) (see table 4.7, below).

Table 4.7: The Installed Capacity and Actual Yield of Boreholes

Sr. No	Boreholes at operation	Installed capacity	Expected yield (m3/day)	Actual Yield (m3/day}	Per centage of actual to capacity
1.	Hoha No.1	4.8l/s	207.360	120.960	58
2.	BH5	3 l/s	129.600	118.800	91.7
3.	BH6	4.72 l/s	203.904	220.896	108
	Total	12.52 l/s	540.864	460.656	85.2

Source: Computed from unpublished data of WSS office, Annex 12.

This implies the amount of water that can reach individual persons in the town per day excluding non domestic users of water is 26l/d/c. The figure falls down when non domestic use is included. In absolute terms the actual production capacity of four boreholes is 460.66m^3/day, but the boreholes do not operate without break even at their actual rate of production. As a result of under capacity production rate and frequent interruption in the operation time of wells, the actual production of water is substantially lower than the expected amount. Production of water also varies with season due to

seasonal variability of yield and total well hours worked. Generally, Water production depends on yield, operation time and number of wells on operation. According to the data obtained from WSS office (1998/09- 2002/03) in addition to under capacity rate of production, limited number of boreholes, and operation time of wells which lower down the actual production of water, the high per centage of water loss (14.5 per cent) has further reduced the actual amount of water supply to 319,988.01m^3 from 374,133 m^3. The amount of water, which actually reached the consumers, therefore, accounts for only 85.5 per cent of the total production (see table 4.8, below).

Table 4.8: Annual water production and loss (1998/09- 2002/03)

Sr/No	Year	Production (m3)	Loss (m3)	Actual amount reached consumers	Per cent age of loss
1	1998/09	86,159	16,194.75	6,994.25	18.7
2	1999/2000	70,152	16,331.22	53,820	23
3	2000/01	62,839	663.7	62,175.3	1
4	2001/02	76,049	3,469.6	72,579.4	5
5	2002/03	78,934	17,486	6,1448	22
	Total	**374,133**	**54,144.99**	**319,988.01**	**14.5**

Source: - Computed from unpublished data of WSS office, Annex13.

As it can be understood from the preceding discussion, the production and distribution systems of the town's water supply are generally inefficient and tied up with serious problems.

As regard to this problems the interviewed respondents including households and different sections of the society identified incompatibility of the supply with population growth and the expansion of the town; frequent interruption of the supply specially in winter season (February - April); and the limited capacity of WSS office interms of technical personnel, finance, materials such as machines, equipments, spare parts and fittings etc. as the major problems among others. So, most of the inhabitants are using water from nearby rivers and traditional hand- dug wells. The following table 4.9 depicts the response of respondents upon their satisfaction by the existing water supply.

Table 4.9: Satisfaction Level of the Existing Water Supply Service of Assosa Town.

Sr/No	Existing water supply is	Number of Respondents	Per centage of respondents
1	Very satisfactory	4	2
2	Satisfactory	7	3.6
3	Unsatisfactory	163	83.2
4	Non respondents	22	11.2
		196	100

Source: Survey data

As indicated above from the table 4.9, above, 83.2 per cent of the respondents is not satisfied by the existing water supply. This implies that even though additional boreholes were drilled by the Immediate Rehabilitation and Extension Programme for the town, still the demand of the society is not met by the existing supply of water. This is because of the fact that four boreholes drilled by Ethiopian Water Works Construction Authority before this Immediate Rehabilitation and Extension Programme are not used as a water sources at present due to failure of the submersible pumps installed in the two boreholes, one dried, and siltation of the fourth borehole. As a result the amount of water that reaches the inhabitants is not adequate, as the government hoped for. The other reason is the existing water supply is characterized by inequitable and inefficient distribution system; low coverage; unscheduled frequent interruption and less quality.

4.2.2.3. Distribution

The system of distribution is the most important aspect of water supply in any community. The type and efficiency of water supply system greatly affects the rate of household consumption. The process of distribution starts from the place of production or the source of supply, in this case from the boreholes. Among the 4 boreholes 2 of them are working by electric power. The remaining 2 are working by diesel generator. Electric power itself is not working by hydropower. It is working by diesel generator. This implies the energy sources of water supply are not reliable and power cut may occur. In addition to this, nowadays oil prices are rising up time and to time. As we have seen from

the preceding section of organizational capacity of WSS office, it can not afford this rising oil costs. This also leads to power cut. Power cut means complete interruption of water supply. Thus, options should be looked in the log-run to mitigate this problem. One possible way of mitigating such problem is using solar energy instead of electric power and diesel generators.

The raw water is drawn off from each borehole and then pumped through rising mainto the booster pumping station (BPS). From there, the disinfected water by chlorination is conveyed to an elevated tank, 12m high with a volume of 200m^3, located about 7.3 km from the BPS. From this tank, water flows by gravity 8.4km to the reservoir located at the Inzi ridge and then to distribution lines and reservoirs.

Obviously, the importance of reservoir as part of the distribution system is to guarantee a continuous supply of water at the time of interruptions in the process of production. This indeed, depends on the number and capacity of reservoirs and on the relative ground elevation where they are situated, if water is to be distributed by gravity.

The water supply system of the town consists of six reservoirs. One at the Inzi ridge, which has 300,000m^3 capacity, one around Air port has 50,000m^3 capacity, the other one in front of WSS office has 20,000m^3 volume. Three around the Stadium of which two of them are paired with a total capacity of 50,000m^3 and the one single reservoir with a capacity of 20,000m^3 .The reservoir at the Inzi ridge is the major reservoir of the source of water supply. From there water is distributed to the different parts of the town through pipelines of different sizes. Finally, the water reaches the consumers in two types of water supply systems, viz. meter connection and public water points or stand pipes.

Inzi Ridge Reservoir

However, it can be well pointed out that the present reservoirs, the rate of meter connection and the spatial distribution of public stand pipes or water points can seldom meet the demand of the community.

Frequent interruptions in production coupled with limited capacity of reservoirs and unfair distribution of water points on one hand and the growing need on the other hand are ever widening the already existing unbridgeable gap between the demand for and supply of water. This unbridgeable gap between demand and supply of water caused different challenges to the community. The first challenge is that shortage of water supply led to poor personal hygiene and environmental sanitation. The second challenge that was encountered by the community is exposure to unprotected water sources that caused water borne and related diseases (jardia, amoeba and typhoid) which in turn penalize the poor medical costs. The third challenge is this unprotected alternative water sources such as rivers and springs except traditional hand-dug wells are found at long distance (averagely 2.5 Kilometers for single trip) from their home and imposed opportunity costs of time, energy and labor during water collection. The fourth challenge is that shortage of water forced the community to buy water form vendors at high costs. That is, water expense per month rose from Birr 14.6 to 18.74 for private meter connection users and from Birr 9 to 16.2 for public water point users.

4.2.2.4. Coverage

The distribution system covers mainly the central part of the town and government built residential areas in 'Kebele' o4 with total coverage of 38 per cent. As per the official data of WSS office there are 601 domestic, 113 private or commercial organizations 56 governmental organizations and institutional connections and 25 public points of which one is non functional. They are estimated to serve 499 HHs or 2,495. However, according to the standard set by World Food Organization 24 stand pipes can serve maximum of 4,800 people, i.e. one for 200 people or 40 HHs.

Most of those inhabitants who do not have access to the piped system draw their water from private hand dug wells or collect from rivers or springs or buy from vendors who collect water from nearby river on donkey back or buy from their neighbors or somewhere else who have their own private connection and selling it at higher price.

The spatial extension of pipeline over any settlement area is surely a pre-condition for supplying the community with piped water. The efficiency of water supply is therefore, determined primarily by the density of pipelines which are in turn influenced by other socio-economic and physical factors. Among these factors, the number and spatial distribution of public water points, regularity of water supply and income level of the community are the major ones.

Inspite of its importance, the spatial extension of pipelines is confined to some parts of the town. Most parts of the peripheral built up areas of the town are currently beyond the reach of pipelines. People living in these areas of the town highly suffer from absolute absence of water supply around their residence. They usually go far off distances in search of water and carry it along and also spend much time even in queuing up near the water taps.

Although there is no documented data about the density of pipelines, the researcher observed through unstructured interviews with different respondents that the pipeline

network is very sparsely laid. According to the information given, Pipelines density in non-residential areas except government built residential areas the so called 'Arba Betoch', 'Silsa Betoch' and hostels that is in commercial and administrative areas, is relatively greater, since priority is often given to such areas where private and government organizations which can afford the installation costs are located.

The problem of line extension is further aggravated by steady and rapid spatial expansion of the built up area crossing the existing municipal boundary of the town, and has influenced the pipeline extension which in turn influenced meter-connection. The challenges that are encountered by the community due to absolute absence of water supply around this new built up and peripheral area is high burden of people per public water points. This implies that many people are queuing at water points for long time that may eventually result in tiredness for water collectors. Sometimes queuing at water points also creates disputes among those waiting in a line when queue jumping occurs.

A meter-connected system of water supply includes both the residential (household) and non-residential (private, public and governmental organizations) consumers. In this study, household meter connections are considered. Residential meter connection system again includes house and yard connections. Yard connections are quite similar to house connections except that the taps are placed in the yard, outside the house.

Distributing water through house connection use is obviously the most convenient system of water supply for households. However, the installation of the residential meter connection involves much higher cost which most of the households in the community under consideration (the poorest of poor) could not afford. Because of financial and other socio-economic factors the rate of private meter connection for household service in Assosa town is very low (see table 4.10. below).

Table 4.10: Number of Sampled HHs without and With Meter Connection.

Sr. No.	**Type of meter connection**	**Number of Respondents**	**Per centage of Respondents**
1.	Private	72	36.7
2.	Shared	25	12.76
3	Without PMC	84	42.86
4.	Non Respondents	15	7.7
	Total	196	100

Source: Survey data

As can be seen from table 4.10 above out of total sample households only 36.7 per cent of these households have private meter connection and 12.76 per cent of the total households have shared meter connection. 42.86 Per cent of the sample households are without private meter connection.

The implication of this finding can be expressed interms of principles of optimal use of water: equity of access, efficiency of use and sustainability of the source. The first implication is that high variation in number of households with and without meter connection shows there is no equity of access to potable water supply. The second implication is that available water is distributed to few numbers of the community in large amounts rather than administering to the majority of the community in small amounts so that the few community with large amount of water supply can use /consume water as they wish without giving due consideration to waste of water. Eventually such unequal/unfair distribution of water leads to inefficient use of water by few numbers of the community. Last but not least, the majority of the people did not get adequate potable water means they are forced to use other alternative sources. This consumption of water from heterogeneous sources leads to depletion of water resources and implies absence of optimal use interms of sustainability of the source.

The rate of meter connections also varies from one 'Kebele' to another. From the following table 4.11, below, the per centage of HHs having their own meter connection ranges from 29.5 per cent in 'Kebele' 01 to 46.5 per cent in 'Kebele' 04. This implies

people in 'Kebele' 04 have ability to afford private meter connection than that of 'kebele' 01.

Table 4.11: Number of HHs with and without private meter connection in kebele 01 and 04

No. of Respondents	Kebele			
	01	%	04	%
With PMC	33	29.5	39	46.5
Without PMC	79	70.5	45	53.5
Total	112	100	84	100

Source: Survey data

It also indicates the fact that, 'Kebele' 04, which is the new establishment area in which government built residential areas are found possessing private house/yard connection rate of more than 'Kebele 01, which is slum area in which relatively poor segments of the society are found.

Such an inter - 'kebele' variation in the proportion of households with meter connection service might have emanated from differences in income level of HHs, pipeline density and distance from the source of water supply. Due to such constraints households face serious shortages of water supply. They, therefore, collect water for any kind of household use from other sources or from water vendors which obviously costs them a considerable time, energy and money.

The impact of this is that households lost their income and time which led to low productivity, burden on home duties and drudgery especially on girls and women. However, the issue of fairness and full cost recovery is still paradoxical to solve such problems of variations in access to social services including potable water. Charging high tariff to cover full cost means the poor can not afford the charge. Again when low price is set or water is provided freely, revenue becomes low thereby resulting in inability to cover the full cost and to sustain the service unless it is subsidized by the government.

The Ethiopian Water Resources Management Policy has also clearly emphasized on the implementation of cost recovery tariff structure as government subsidy is becoming out of question. This modality is in order to provide efficient and sustainable service through a sound financial and technical management of the system. The policy has also given concern to the ability of the poor to pay by the term (category of) "social tariff" in which the poor are charged less by assuming that the well-to-do consumers will cross subsidize water supply.

The position of the researcher here is that water supply should be charged rather than being free, but the way of charging customers should be based on their self selection of the service and volume of water consumption. This means the poor and other customers should select the service type in accordance with their income level and the price would be charged based on volume of their water consumption. This can enable efficient use and sustainability of water supply.

Withdrawing water from traditional hand dug well

Water vendors collecting water from 'Arba- Sebat Wonz'

As a result of this sample survey, the number of households that consume pipe water (who have access to pipe water) compared to other sources also constitute 69.9 per cent of the households. But this does not mean this 69.9 per cent of households is using pipe water only. They also use other sources such as traditional hand dug wells, river, springs and rain water (see table 4.12, below).

Table 4.12: Number of HHs Using Different Sources of Water.

Sr/No	Source of water	Number of Sample HHs Using the source/s	Per centage of Sampled HHs Using the Source/s
1.	Piped Water	137	69.9
2.	Private hand dug well	35	17.9
3.	Spring	5	2.6
4.	River	14	7.0
5.	Non respondents	5	2.6
	Total	**196**	**100**

Source: Survey data

The remaining inhabitants collect water either from one or combination of sources for their household consumption. This implies there is absence of regular water supply in the town, that is, more interruption takes place and also the other sources are not reliable. This implies households should have reservoirs to gather water such as pipe water and also construct ponds to collect rain water to solve shortage of water during unexpected interruption.

Generally, the distribution of water through pipe water system covers only 69.9 per cent of the town's population and not only its efficiency but also its equity in distribution has been limited by the problems so far discussed.

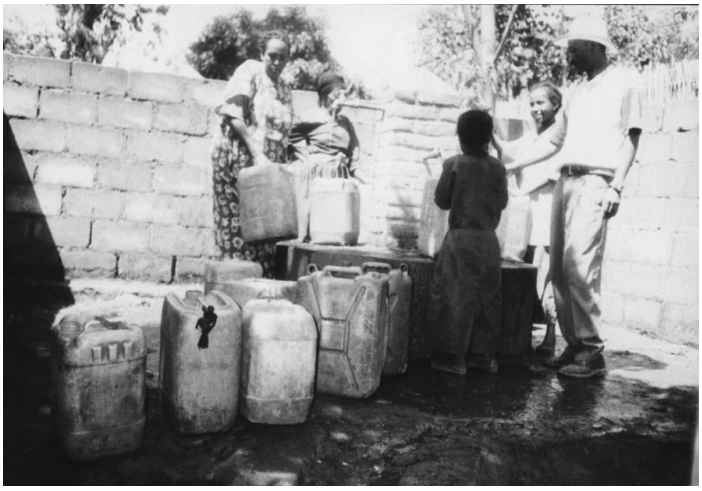
In communities where the rate of private meter connection is hampered by financial constraints, the feasible and economical system of water supply for household use is through public stand pipes (water points). This is because of the fact that in spite of their shortcomings; public standpipes are the practical options for water distribution at a minimum cost to a large number of people who can not afford higher costs of house or yard connection.

Of course, the selection of the type of water supply system depends primarily on financial status of the population to be served and on the amount of water available for supply. As majority of the population fall in the low in come brackets (Annex 7) and the production of water that can reach the consumers is inadequate, public water points are thought to be the appropriate means of water distribution in the town of Assosa. The efficiency of the service through public water points, of course, depends on the number and rational distribution with adequate and continuous supply of water.

However, the number of public standpipes currently on service is very low (24) as compared to the population size, majority of which lacks private meter connection, and total area of the town. Moreover, the existing few public water points are not evenly distributed through out the town even though WSS office set number of population, distance from water point and the place where people unable to afford private connection are living as the major criteria to allocate it.

The limited number and inequitable distribution of public water points coupled with frequent interruptions of water supply reduces the number of public tap users. This unequal or distant location of public water points from home creates inconveniences for user households interms of time, energy and labor. Thus, people in Assosa town often use

other sources such as private hand-dug wells which is very tedious particularly when they draw water from the well and when they bring from rivers and springs walking over a long distancse. The existing public water points user as per the official data is 23.5 per cent of the total population of the town (4800 people), assuming that one 'Bono water' (water point) serves for 40 households or 200 people (see annex 11).



Fetching water from public water points

The survey result also showed the existing public water point users constitute only 20.4 per cent of the sampled households while those without private meter connections use meter connections of their neighbors, and water from other sources (see table 4.13, below).

Table 4.13: The number of HHs using Private Meter Connections, Public water points and Other Sources.

Type of water Supply System	Number of HHs using the sources	Per centage of HHs using the sources
Private connection	72	36.73
Public water point	40	20.4
Private connection shared with neighbor	25	12.76
Other sources	45	22.96
Non respondents	14	7.14
Total	**196**	**100**

Source: Survey data.

Others: Include private hand dug wells, rivers, and springs, and combination of water sources.

According to the data obtained from WSS office, at present one public water point stands for 727 people, excluding private meter connection owners, which is twice more than the standard set for public water point users, 30-40 HHs or 150-200 people (see annex11).

Based on the above maximum population limit the existing public water points in Assosa can serve 4800 people accounting for only 27.5 per cent of the population without private meter connection service subscribers (17 455). The remaining 72.5 per cent is not covered with the recommended reasonable population load per a single water point (See annex 11). The per cent age gap between the official data and sample survey may be the coverage would not only depend on number of public water points but also on its regular service provided for long time in sufficient amount of water without interruption and using shifting system of water supply as well. However, shifting system of water supply has got advantages as well as disadvantage. Its advantage is that it can solve the problem of absolute absence of water supply by providing water turn by turn for different areas of the town when there is shortage of water from the source. Moreover it can encourage efficient use of water and adoption of container which could be a guarantee during interruption. In contrast, its disadvantage is that customers would be exposed to use of other unprotected sources and incur high costs by buying water from vendors during the interruption of water in their turn.

In addition, it should also be noted that the built up area of the town is growing fast. The fast spatial expansion of the town creates additional demand for water, which calls for the extension of pipelines to the newly incorporated areas. The best possible system of water supply to meet such a growing need will still be through expanding the number of stand pipes with efficient system of distribution (taking density of the population into consideration and distance between stand pipes during allocating water points) and adequate supply from the source. In such circumstances it is important to mobilize the community, CBOs and self help with groups that can help the installation of public water points through labor and financial contribution.

4.2.2.5. Consumption

In urban communities the problem related to household water consumption patterns involve various components even though it effects vary from one urban center to the other and among communities. Among other factors physical and socio-economic factors are the major ones.

As mentioned in the preceding section of this paper, the main sources of water for Assosa town are private hand dug wells, private connections, public water points, rivers and springs. But most of the households do not use the same source for different purposes rather they use the combination of these sources for their domestic use (see table 4.14, below).

Table 4.14: Sources of Water and their Purposes

Sr/ No	Purposes of water sources	Sources used and per centage of respondents									
		Pipe water	%	Traditional Well	%	River	%	Spring	%	Rain water	%
1	Drinking and cooking	107	54.6	27	14	6	3.6	7	3.6	-	-
2	Clothes washing	29	15	102	52	9	4.6	3	1.5	6	3
3	Animal watering	15	8	61	31.1	-	-	2	1	1	0.5
4	Floor washing	19	10	101	51.5	4	2	2	1	4	2
5	Bathing	43	22	89	45.4	8	4	3	1.5	1	0.5
6	Gardening	19	10	69	35.2	-	-	2	1.02	-	-

Source: Survey data

From the table 4.14, above we can observe that households are using different sources for different functions. As indicated above traditional hand-dug well stands first in its purpose except for drinking and cooking. Even 14 per cent of sample households use it for drinking and cooking. Other sources have also their own contribution for different functions. This implies how the households are exposed to other unprotected water sources. Thus, it is important to give due attention in protecting such sources, to make them safe sources for drinking purpose.

Synchronizing either by making these different sources safe for drinking and cooking through different mechanisms such as chlorinating the traditional hand dug wells, spring development, adopting the culture of boiling and filtering these sources of water or using them for functions other than drinking and cooking can help to solve the shortage of pipe water supply or to reduce the burden of demand on pipe water supply and can ensure optimal use of water.

The first and the most influential factor that affected water consumption of urban inhabitants in Assosa town is the nature of the source of water with respect to quantity and quality. Low quantity was expressed as a more serious problem by different sections of the society interviewed for their water consumption. The issue of quantity supplied is so far discussed.

With regard to its quality the suggestion given was that even though the water is treated, it is not somehow good because turbidity of water occurs especially during dry season with suspensions of impurities and small particles. Moreover, it causes water borne and water related diseases that attack the family viz. amoeba, jardia, typhoid and etc. The following table 4.15 shows comments of sampled households on water quality of Assosa town. 54.6 per cent of sample household's commented the water supply has the problem of turbidity (see table 4.15, below).

Table 4.15: Comments on Water Quality of Assosa town by Sampled HHs.

No	The problem of water quality is	Number of Respondents	Per centage of Respondents
1	Salinity	10	5.1
2	Chemically unfit	21	10.7
3	turbidity	107	54.6
4	Carries insects	24	12.24
5	Non Respondents	34	17.35
	Total	196	100

Source: Survey data

The other physical factor which affects the use of water within each household is the physical distances of housing units from the water point. Fore instance "Bono water" users walk average distance of 500 m for a single trip. Thus this distance is greater than the reasonable access defined by World Health Organization (WHO) in Mequenet (1998:46) to safe drinking water in urban areas i.e. 200 m for housing unit. The table 4.16 below reveals daily water consumption (litters per HH per day) by type of connection.

Table 4.16: Difference in Daily Water Consumption by Type of Connection

No	Type of connection	Amount in letters
1	House /Private connection	100
2	Public water point	75
	Difference	25

Source: Survey data

It is observed that the average per HH per day water consumption for houses with private meter house connection is 4 jericans whereas, for houses using public stand pipes it is only 3 jericans. Thus, the per HH per day water consumption of houses with private pipe connections is 1.3 times that of houses using public connections (see annex 8 and 9). From this it can be concluded that physical distance of the housing units from the water point had inverse relationship with the amount of water consumption despite other factors affecting water consumption such as purchasing power, household size, household income, etc.

The consumption of water is usually higher in dry seasons, with no rain and hot temperature. The high water consumption in hot climate is caused by increased bathing and drinking more water than in cool humid climate (see table 4.17, below).

Table: 4.17: Average Monthly Temperature and Water Consumption

Month	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug
Average Temp rapture (0c)	20.45	20.05	20.05	21.45	21.45	25.15	19.4	25.7	23.45	20.7	19.7	20.25
Average monthly water Consumption (m3)	2.75	3.25	3.5	3.5	3.75	3.75	3.75	3.75	3.75	3.25	2.26	2.25

***Source**: Survey for Consumption Data*

. BGRS Meteorological Branch Office for Temperature.

The rate of water consumption also depends on the pressure of the water system. One of the problems of water supply system in Assosa town is inadequacy of pressure to satisfy the need of people. Pumping distribution method needs energy to force the water from the sources to the mains and then to the consumers even though gravity system is there also. This incurred power cost. In addition to this, power failures mean complete interruption in the water supply system and then less consumption. Most of this interruption occurs in winter season (February to April) when consumption in reverse increases. This is because of the fact that, as the informants mentioned, water table decreases from the sources especially in dry season (Bega).

When such unexpected power cut or failure occurs and complete interruption is caused, the households faced different challenges mentioned in preceding sections that in turn leads to low productivity, low income and poverty. Thus, it is important to think over about the appropriate technology that could be cost effective to solve such problems. For instance, in the long run using solar energy as the source of power will be more appropriate and cost-effective technology as well compared to using diesel generators which require fuels and oils as its inputs that cost huge amount of money for WSS office.

There are also other factors mentioned as reasons for water interruption in Assosa town. These include: break down of pipes, official decision for both electric and diesel motors to take a rest per day, technical problems such as inability to fit the spare parts, lack of spare parts and skilled man power. These factors affect the amount of water supplied and then the amount of consumption. The table 4.18 below shows frequency of interruption in pipe water supply system. These problems can be curbed by staffing the WSS office with skilled technical personnel and material resources. But the more serious problem faced by WSS office is decreasing water table especially during peak dry season. Unlike other resources we have no substitute for fresh water. Thus, to overcome such serious problem due consideration should be given to the conservation and assurance of supply. One more important way is conserving and recharging the natural ground aquifer by afforesting water catchments that can regulate flow of water as well as helps to reduce the transfer of sediment into the reservoir. Moreover, waste curbing and introducing reuse of waste

water for purposes such as gardening non-edible flowers, using for cleaning latrine and etc. through continuous education programme might help the conservation effort of water resources.

Table 4.18: Frequency of Interruption of Water Supply

Frequency of interruption	Number of Respondents	Per centage of Respondents
Once a day	4	2.04
Once a week	25	12.76
Two ice a week	27	13.8
Seasonally	57	29.08
Monthly	36	18.4
Non respondents	47	23.98
Total	196	100

Source: Survey data

When we observe the frequency of interruption from the 4.18 table above more frequent interruption occurs seasonally (Varying between "bega" and "kiremt"). 29 per cent of the respondents justified this interruption whereas 18.4 per cent of respondents responded that the interruption occurs monthly. High per cent age of respondents for seasonal variation can attribute the fact that the water table of boreholes decreases in dry seasons. The survey result also showed 61.7 per cent of informants responded the water supply interrupts during 'bega' season and 20.4 per cent responded interruption occurs in 'kiremt' season (see table 4.19, below).

Table 4.19 Seasonal Variation in Water Supply Interruption

More interruption takes place in	**Number of respondents**	**Per centage of Respondents**
'Bega' Season	121	61.73
'Kiremt' Season	40	20.408
Non Respondents	35	17.9
Total	196	100

Source: Survey data

When such unexpected interruption takes place households encounter multidimensional problems. In addition to the challenges mentioned in the preceding sections HHs are

exposed to high cost of drinking soft drinks and mineral water, at schools students leave school specially Muslims since they can not take bath after using the latrine. Of course, priority is given for Assosa hospital. Frequent Interruption of water supply has also direct impact on economic activities. For instance, interruption of water supply creates a problem on house construction in the Assosa town. This seasonal variation in interruption of water supply implies the need for having containers and constructing even ponds to gather water during rainy seasons for dry season, when more interruption occurs. This might help to minimize the problem of shortage of water and its consequences during the dry season.

To solve such problems there should be an integrated effort by different actors such as government, community and NGOs, to construct common rain water gathering places/ large ponds/ at reasonable distances so that the community can draw water from those sources during dry season for their house construction and other economic activities.

Moreover, urban dwellers faced the problems when they collect water from other source during interruption They walk for long distance (average 2.5 km) and it takes 50 minutes for single trip, incur high costs (0.5 cents per jerican), loss of energy or fatigue and long waiting time at water point (1/2- 1 hour).

In Assosa town the socio-economic factors also affect the rate of household water consumption. Among the socio-economic factors that affected household water consumption patterns the significant ones are the urban growth, household income and household size.

The growth of Assosa town interms of population increased demand for more water. That is, the daily water consumption has increased from year to year. The rapid concentration of and rising living standard placed constantly growing demand on domestic use of water. Thus, the problem of drinking water supply in Assosa town is not only a result of shortages of potable water in the sources but also due to growth of urban population and urbanization.

As per the official data given by WSS office consumption of water in Assosa town increased from 69964.25m3 in 1998/99 to 89657 m3 in 2004/05, the difference being 19692.75 m3 0r 28 per cent (see Annex 13).

The other socio - economic factor affecting the household water consumption in the town is income level. That is, the volume of water consumption increases with living standard and income of the people.

Besides, household sizes (4.06) also affected the volume or rate of water consumption. The total consumption per household increased as evidenced by the yearly increment of consumption indicated in annex 13. The challenge here is that when there is more demand for water given limited source of water supply, the amount of water that reaches inhabitants becomes inadequate. Inability to get adequate safe water means poor health and low productivity of the society which calls for shifting government investment from equally important sectors towards this sector. Hence, there is the alternative benefit for-gone due to excess demand of water. This leads to low national income, poverty and then low living standard or well-being of society.

4.3. Water tariff setting in Assosa town

It is emphasized that there should be different levels of cost recovery. Among these cost recovery levels, Assosa town as one of the small towns was given a mandate at least to cover minimum cost of operation (fuel, staff salaries for the water points, cost of water treatment chemicals etc) and maintenance (labor, tools, equipment, spare parts, etc) costs. Accordingly, the water Board of Assosa town sets the price of water for consumers and then the regional government approves it.

However, fairness of the price set for private connection to the poor community on one hand and on the basis of cost recovery on the other hand is questionable. The existing price of the water of the town's water supply service is 3.81 Br/m^3 for public water point users, which is a flat rate. For private pipe connection users the price is set as 4.57Br for those

who can consume 1-2m^3 of water. For those who can consume 3-4m^3, the price is set as 5.46Br. Finally, for those who can consume more than 4m^3 it is 3.96 (see Annex 15).

As can be observed form the prices given above for private pipe connection users, the one who consumes more pays less price and vise- versa, i.e. after certain limit of consumption, 4m^3. This pricing approach subsidizes the high-income level community and increases burden on the poor people or it is not fair for the poor in other words.

Rich people, business organizations and government institutions consume large amounts of water and are financially better off than the average consumer. Thus, to earn substantial amounts of revenue and to ensure more rational use of water, higher rates should be set for them. Even though the tariff set is a progressive approach, it favors water vendors as they pay less for the town's WSS office and generate more money by selling water at higher price. Such kind of progressive tariff is not socially acceptable as it utilizes the option of cross subsidies in favor of the urban rich. Thus, the proposed tariffs for the high income by the Consultant, BIK Engineering PLC (2003), should be applicable in such a way that higher income consumers should pay more per unit volume of water as consumption increases beyond a given limit, in this case greater than 4m^3. This is socially justified and helpful in adequate revenue generation.

Even though the objective of tariff setting is to make the cost recovery system effective and so set by Board most of the sampled households, and other governmental and non governmental institutions were not aware of the water tariff setting in Assosa town. Such non participatory approach cannot ensure sustainable supply and optimal use of water.

According to the result of survey, the sampled HHs had given their comments on the water price of Assosa town. Out of the total sample households 54.6 per cent commented the price set is unfair especially for private pipe connections. Other 26 per cent commented the price as fair may be for those who pay less when they consume more (see table 4.20, below).

Table 4.20: The Comment of Beneficiaries on the Existing Water Price of Assosa Town

Comments	Number of Respondent	Per centage of Respondents
Fair	51	26
Unfair	107	54.6
Non respondents	38	19.4
Total	196	100

Source: Survey data

The customers forwarded their own suggestion to improve the price set. That is, two members of the community participating in Board decision are not representative enough to reflect the feelings of the whole society. Thus, the price what they intended to pay is averagely 3.30 /m3 or 0.08 Birr/jerican for private meter connection users and for those who are using 'Bono water' the existing 0.1 Br/Jerican should be 0.05Br/Jerican or 2Birr/m3. They suggested this price on the ground that water supply is not convenient or reliable, and does not have reasonable quantity and quality. In other words, due to its unreliability most of the time they are exposed to additional cost by buying water from water vendors in the town. It was also suggested that the price should be based on volume of water consumption.

Regarding its fairness, the price has been suggested by BIK Engineering PLC (2003) taking due consideration upon the monthly average household income and water consumption. The study suggested Birr 5.03 - Birr 9.17/m^3 as fair tariff for Assosa town. In other words, the fair price range was 0.13Br/jerican to 0.23Br/jerican. However, as mentioned in the preceding section the present price is not according to these fair price ranges set by BIK Engineering PLC (see table 4.21, below).

Table 4.21: The Difference between Tariffs Set as Fair to Customers by BIK Engineering PLC and the Present Actually Set Price by Board of Assosa Town Water Supply

No	Consumer Category	Tariff Block (m^3/month)	Tariff, Birr/m^3	
			Proposed	Actual at present
1	Public Taps			
	. Price A	-	2.28	-
	. Price B	-	3.81	3.81
	. Price C	-	12.12	-
2	House/ yard connection Price			
		1-2m^3	-	4.57
		2-3m^3	2.74	-
		3-4m^3	3.27	5.46
		> 4m^3	3.96	3.96

Source: For Proposed Tariff, MoWR, 2003:41

It can be seen from the table that proposed tariff for house connection increases (from Birr 2.74 to 3.27) with the volume of water consumed (from 2-3m^3 to 4m^3) and increases to Birr 3.96 for more than 4m^3 whereas that of the actual price set by the Board increases from Birr 4.57 to Birr 5.46 with volume of water consumed (from 1-2m^3 to 3-4m^3) and then declines to Birr 3.96 when more than 4m^3 volume of water is consumed. This implies that the tariff set at present is not based on the study and not fair to the poor community.

The survey result of this study also shows the monthly average household income is 1,488 and water consumption is 4jerican/HH/day on average. The average household size is 4.06. For the households with this characteristic the water tariff set is not fair especially for the poor segments of the people. The variation in access to potable water can be well described by the per cent age of households based on occupation. Government employees scored 49.5 per cent of the total sample HHs in consuming water from pipe water. Others included businessmen, 8.2 per cent, daily laborers 9.7 per cent, farmers' 1per cent and others 1.5 per cent (see table 4.22, below). This implies communities with better income can afford the price and have more access to water supply service.

Table 4.22: Number of HHs Using Pipe Water by Occupation

Sr/ No	Occupation	No. of Sampled Households Using Pipe Water	Per centage of Sampled Households Using Pipe Water
1	Government employee	97	49.5
2	Business men	16	8.2
3.	Daily Laborers	19	9.7
4.	Farmers	2	1
5.	Others	3	1.5
6.	Non Respondents	59	30.1
	Total	**196**	**100**

Source: Survey data

4.4. Further demand and willingness to pay for improved water supply

Analysis of the households' willingness to pay (WTP) shows that 75.5m per cent of the households interviewed were willing to pay for an improved water service whereas 16.3 per cent of the interviewed households were not willing to pay for improved water supply (see table 4.23, below). This indicates that the majority of the households have further demand for better service than the existing service.

Table 4.23: The Number of Households Willing/ Unwilling to Pay for Improved Water Supply Service

Sr/ No	For Improved water supply service	Number of Respondents	Per centage of Respondents
1	Willing to pay	148	75.5
2.	Unwilling to pay	32	16.3
3.	Non Respondent	16	8.2
	Total	196	100

Source: Survey data

Households suggested different ranges of willingness to pay per jerican. The average WTP value for improved water is 0.23 Br. per jerican ranging from 0.10Br to Br 0.80 (see table 4.24, below). However, this willingness to pay depends on income of household size, household age and satisfaction level with the existing source. Such price

based on felt need of the community is a good demand management strategy to ensure optimal use of water and make sense of economy for water supply.

Table 4.24: Willingness to Pay per Jerican

WTP values /Jerican	Number of Respondents	Per centage of Respondents
0.10	55	28
0.15	7	3.6
0.20	21	10.71
0.25	8	1.08
0.30	7	3.6
0.40	2	1.02
0.50	20	10.2
0.80	2	1.02
Non Respondents	74	37.8
Total	196	100

Source: Survey data

The willingness to pay per jerican show that if the supply is provided in the form of house connection which is well treated physically and chemically and in sufficient amount with bathing and latrine water, the households are willing to pay for such service. This implies there is further demand for water supply in Assosa town. There is further demand or ability and willingness to pay for improved service means generating high revenue for WSS office at high price assuming the capital budget required for the provision of improved water supply service would be available. It is advisable to provide quality service at high price based on self-selection of the service by the customers rather than less quality at low price of the water supply service.

From the above willingness to pay per jerican the average price the consumers are willing to pay if the water supply service is improved is 0.23Br per jerican (25 litters) this price is equal to 9.2Br/m^3. This shows there is a great difference between the existing maximum price set by WSS office, 5.46Br/m3 and the average willingness to pay value, 9.2Br/m^3.

The gross revenue difference can be shown from this price difference. Total revenue is the value given by total quantity demanded multiplied by price. In this case, the quantity of water sold and unit price charged for that amount of water.

Assuming that the whole communities are willing to pay for the improved water supply service, the revenue difference between the existing water supply and the proposed improved water supply can be shown as follows:

Revenue= P x Q

Total Revenue= p x TQ

Where P= price of water (average willingness to pay value)

Q= Quantity demanded of water

TQ= Total quantity demanded

In this case, P = Willingness to pay value =9.2Br/m^3

Q = Average daily water consumption Per HH /day

TQ = Total HH x Q

Given:-

P = 9.2Br/m^3

Total HH = 4092

1 Jerican = 25 litters

1m^3 = 1000 litters

Average quantity demanded per HH/day = 4jerican

TQ = 4092x4jerican /day

= 16368 jerican /day

= 409200 litter /day

= 409.2m^3 /day

Thus, Revenue = TQ x p

= 409.2m^3 x9.2= 3764.64Br/day

Monthly Revenue = 3764.64x30days= 112,939.2Br

Yearly/Annual Revenue = 112939.2x12 month= 1.355270.4

When we compare these revenue with the actual revenue generated by WSS office of Assosa in 2005, i.e., 503,508 Br (see annex 16) the difference is Br 851,762. But if we take only the communities willing to pay for improved service we get 3,089.5 * 4 Jerican = 12,357.84 Jerican per day = 308,946 l/day = 308.946m^3/day.

Thus, revenue = 308.946 m^3/day * Br 9.2 = Br 2,842.30/day.
Monthly revenue = 2,842.30/ day * 30 days = Br 85,269.096.
Annual revenue = 85,269.096 * 12 months = Br 1,023,229.15.

When we compare this revenue with actual revenue collected in 2005 the difference is 519,721.15.This implies the WSS office needs to improve its water supply service to charge the reasonable price and to collect sufficient amount of revenue to run and sustain the service delivery though willingness to pay is conditional and service improvement deserves additional investment cost. In addition to this, the revenue calculated is not net revenue, i.e. the gross revenue of both existing and to be improved is compared.

4.5. Challenges of water supply in Assosa town

Rapid growth of population: the steady growth of town's population due to natural increase and migration coupled with the expansion of the town imposed high burden upon the utility office of Assosa town, WSS and it becomes difficult to accommodate the ever growing population. The problem is exacerbated by the failure to design optimum use of water for the town due to underestimation of population growth based on national population growth rate while the growth rate for Assosa is beyond that growth rate.

Inadequate water supply: There are limited numbers of boreholes with limited potential yield. The supply decreases more during the dry season. In addition to this, there is frequent interruption of the supply, which reduced the actual production to be less than the expected amount. There are no mechanisms developed to solve these challenges. Even the existing different sources of water are not synchronized to modern water supply; conserving or recharging natural ground aquifer such as afforesting water

catchments areas that can regulate flow of water is not exercised. Moreover, curbing waste water and reusing for different purposes is not introduced to the community.

Unfair distribution of Water: The rate of meter connection and the spatial distribution of public stand pipes or water points do not meet the demands of the community. The distribution system covers mainly the central part of the town; government built residential areas and the area where different organizations are concentrated. Most parts of the peripheral built up areas of the town are currently beyond the reach of the pipelines. When we see the spatial distribution of public stand pipes in the town only five are found in kebele 01, of which one is non functional whereas seven public water points are located in kebele 04, in which relatively less number of people are living.

Loss by leakage: In addition to the under capacity rate of production which lowers down the actual production of water supply, water loss has further reduced the amount of water supply that can reach the customers. This challenge is exacerbated by choice of inappropriate technologies that can not meet appropriate standards. Measures to enhance sustainability of urban water supply schemes should emphasize on choice of technology and development of supply chains in relation to technology choices that makes access to spare parts and fittings easier and cost effective.

Limits to water consumption: Various physical and socio-economic factors limited water consumption by households in Assosa town. To mention some of them: inadequate supply and poor quality, the physical distance of housing units from water point, unreliable distribution due to weak pressure and frequent interruption etc. Among these factors, which limit the amount of water consumption, interruption of water supply is a more serious problem. During unexpected water supply interruption households encounter multidimensional problems as mentioned in the preceding sections. The growth of the town interms of population, household size and income has also its own influence upon the water consumption by households.

Unfair tariff and connection charges for the poor: the water tariff set by the Assosa WSS office and the Board of Assosa town water supply for private connection and its connection charges is unfair to the poor segments of the community. This is because of the fact that those who consume more volume of water pay low price due to the price set in this manner and also the high connection charges. This implies that the tariff subsidizes the urban rich, as they are the one that can afford and consume more than the poor and can also sell from their private meter for the poor at higher price than the price they paid for WSS office.

Root causes of the problems

Management problems: management problems caused by inefficient organizational structure, understaffing, low salaries and lack of staff motivation and inability of the WSS office to retain trained and experienced staff is the main constraint to service delivery.

Lack of institutional coordination: major stakeholders in Assosa town water supply activities include Regional Water, Mines and Energy Resources Development Bureau, Assosa town water supply Board, WSS office and the community. However, there are no coordinated linkages among the bureau and WSS office except for technical support, implementing construction works of water which is its responsibility and in Board decision in which the head of Water, Mines and Energy Resources Development Bureau is the chairman. Different professionals are not incorporated in Board members to exploit their technical knowledge. The community is represented by the two-delegated members. Thus, the poor institutional coordination hampered the efforts to achieve WSS office goals.

Limited budget /funds: Delivery of urban water supply requires a high level of investment. Lack of sufficient funding has limited the quantity and quality of water supply service of the WSS office. Moreover, lack of effective cost recovery mechanism

often inhabited the WSS office from sustaining even the existing service and fulfilling its mandates (see annex 16).

Lack of capacity: Shortage of skilled manpower is the critical issue faced by the WSS office. This constraint is also the most limiting factor in the fulfillment of its desired service provision. In addition to this, in adequate equipment facilities and other material resources further exacerbated the nature of the problem (see table 3.8).

Low community participation in decision making: Individuals and communities, the private sector and NGOs have very important roles to play in the implementation of WSS activities and in achievement of water supply schemes. However, there is no participation of these important stakeholders in Assosa town water supply service activities except the two community members participating during Board decision. WSS office is the only mandated government body to supply water for Assosa town inhabitants to satisfy their need. Thus, it is difficult for WSS office alone to meet the ever-growing demand of the population. Involving the community during planning, implementation and operation phases of the scheme and delegating those helps to create sense of ownership to ensure the sustainability of the water supply scheme. In addition to this, it is also important to establish water committee with membership of women and well developed reporting format and system to get feed-back on issues of water supply. Based upon these findings discussed the conclusion and recommendations are made here under.

CHAPTER FIVE

5. Conclusions and Recommendations

5.1. Conclusions

The water supply of adequate quantity and acceptable quality is one of the basic needs of human beings, but the provision of potable water in Assosa town has been inefficient and poor in quality. The situation is getting worse due to the population growth and spatial expansion of the town which outstripped its ability to supply sufficient water for inhabitants.

The existing sources of potable water for Assosa has been underground water which reaches the customers through meter connection and public water points. However, since the source is only from underground water which is characterized by decreasing water table, especially during peak dry season, the amount of production is not adequate even for those who have access to it. The amount of production is also further reduced by less well working hour, limited number of boreholes and loss by leakage.

Moreover, the state of water supply in the town interms of coverage both in spatial and population, reliability, accessibility, and sustainability is not at the required standard. The rate of meter connection is low and the distribution system is inefficient. The major constraints of distribution system identified are low density of pipelines network, limited number of public water points and their unfair distribution, low capacity of reservoirs and inadequate pressure in the pipe. As a result, water consumption is affected in the town due to these physical factors in addition to socio-economic factors such as population growth, household income and size that affected their water consumption.

The water tariff set in the town is also not fair and did not cover cost of the service to fulfill the principles of cost recovery. This is because of the fact that the price is not charged based on volume of water consumption. After certain limit of consumption the

customers pay low price for higher volume of water consumption. Such price charging, subsidized the rich and favored water vendors. The majority of the victims of the problem are the poor as they can not afford the connection charges.

Thus, it is observed that the water supply approach in the town is concentrated on traditional systems of service coverage, service pricing and mandated institutional arrangements for service delivery rather than identifying self selection of the service type, consumers' willingness to pay, consumption based service charging and emerging partnerships with NGO, CBOs and private sector.

Because of these poor functioning of the existing water supply service most of the households in the town are willing to pay higher price for improved water supply service if government provides it. This prevalence of willingness to pay implies two things: there is further demand and the existing water supply service is not convenient for the customers so that they need better service at higher price. Thus, WSS office could have been generated sizable revenue if it could provide better water supply than the existing one.

Therefore, the problems of water supply in Assosa town are multidimensional interms of both efficiency and equity. Among the problems identified inadequate water supply, inequitable and in efficient distribution system, low coverage, unfair price and the resultant limited consumption are the major ones. These problems imposed different challenges on inhabitants such as lose of time, energy and money; exposure to water borne and related diseases which penalizes the poor medical cost and pay high price for water vendors.

The root courses of these problems and challenges are management problems: inefficient organizational structure, under staffing, lack of staff motivation; lack of institutional coordination; lack of sufficient funding and capacity and absence of community, private, CBOs, and NGOs participation in the implementation of WSS activities.

Thus, policy and planning on development of adequate, reliable, fair, sustainable and effective water supply should be established based on a better understanding of what impediments are there in water supply management and what improvement in water supply service people need and willing to pay.

5.2. Recommendations

Improving the existing water supply service in the town both interms of quality, quantity, reliability and sustainability means upgrading the socio-economic welfare of the people in the town. Thus, the following measures need to be taken to reverse the existing challenges:

Conduct detail study: conduct detail study on both underground and surface water and merge both sources to create potential source of water supply if financial and environmental conditions allow;

Demand oriented supply: design future water supply strategy based on demand orientation, i.e., self selection of the service type by customers rather than past trends and population figures;

Demand management: manage the demand by controlling waste or loss from pipe leakage and consumption through the use of meters and tariffs that are set in accordance with volume of water consumption;

Community participation in decision making: involving the community and CBOs at all levels of water supply program and allow private sector involvement in different components of water supply service such as provision of pipes, meters, equipments, machines etc. In addition to this, NGOs should take part in the rehabilitation of already constructed projects to minimize financial burden of the mandated agency, WSS office;

Mobilize resource: mobilize resources required to bridge the financial gap. This may include organizing donor's conference, meetings with individual donors and introducing water supply development program at meetings of the general public;

Short term credit: since the poor segments of the urban community can not afford the cost of meter connection charges, pipes, meters and other necessary inputs should be

provided on the basis of short term credit in the form of either individual or group lending to enable the poor people to afford the services;

Equitable distribution: water points and pipes ought to be evenly distributed in order to address the problem of the low income group. Moreover, installation of additional public water points would narrow down the gap between demand and supply taking into consideration the number of people, density and distance between water points;

Strengthen the institutional capacity: the institutional structure should be staffed with qualified personnel and equipped with required facilities;

Flexibility of rules and regulations: rules and regulations regarding staff salaries and benefits should be flexible realizing that required staff otherwise may not be available;

Creating conducive environment: It would be advisable if the government takes necessary steps to create conditions conducive for participation of the private sector in program implementation activities.

Conserving water resource: Water resources should be conserved and recharged by the natural aquifer covering the water catchments with forests that can regulate water flow and minimize reduction of water table.

Water recycling: this refers waste curbing and reuse of waste water for purposes such as gardening non-edible flowers, cleaning latrine and etc.

Construction of ponds: constructing either individual or common ponds to gather water during rainy season for the sake of solving shortage of water during peak dry season would help harness the prevailing challenges. However, technical support should be given for the community how to construct and use the pond.

Synchronization of water sources: water sources can be used for different purposes. Potable water can be used for drinking and cooking purpose while other sources such as traditional hand-dug well, river, spring and rain water can be used for clothes washing, animal watering, floor washing and bathing etc. In addition to this, by chlorinating, boiling and filtering those other sources they can also be used for drinking and cooking functions/ purposes and this can mitigate the shortage of potable water supply.

Using water reservoirs: containers are the guarantee for frequent interruption of water supply. They solve the problem of complete absence of water supply by storing water.

Therefore, it is important to agitate the community to have containers to overcome absence of water supply especially during peak dry season.

Employing appropriate technology: appropriate technology that can meet appropriate standards and can have adequate spare parts and fittings should be applied. Even in the long term the use of solar energy rather than diesel generators would be appreciated. This can minimize the rate of interruption. Moreover, advantage of using pit latrines rather than modern toilet facilities should be given due consideration as they do not need water after defection and can save water consumption. But they should be spaced at reasonable distance from water sources.

Controlling squatter settlements: illegal spatial expansion of the town across the municipal boundary of the town makes the extension of pipelines and then distribution of water points difficult and leave out the firing/ peripheral areas out of the reach of potable water. Therefore, rules and regulations ought to be set to control such illegal settlements around the town.

Application of cost recovery principles that can afford the poor: On the whole, relative level of access to potable water in urban areas is estimated to be high. However, the poor lack access. The challenge is the existing paradox between charging high tariff to cover full cost and fairness of the poor. In other words, high tariff means high revenue but unfairness for the poor. Thus, the solution might be setting "social tariff" that leads to charge the poor less by assuming revenue from the rich can cross subsidize water supply. In addition to this, both poor and rich communities should select the type of service in accordance with their income status and the price should be charged based on the volume of their water consumption which can ensure efficient use and sustainability of water supply.

Ensuring the principles of optimal use of water: the available water should be equitably distributed to the community to ensure equity of access. This equitable distribution of water to the community not only ensures efficient use of water but also leads to consumption of water from homogenous sources and maintains sustainability of the source thereby curtailing its depletion.

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