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Assessment of Water Supply and Sanitation in Bishan Guracha Sub-City in West Arsi Zone

*Moges Tariku Tegenu
Department of Hydraulic and Water Resources Engineering
College of Engineering and Technology, Wolkite University, P.O.Box_07, Ethiopia

Abstract
It is well known that water is a natural resource without which all living things cannot exist. It is a natural requirement for all living things to have access to water if they have to be alive. It seems so why the 70 percent of our planet, earth, covered by water though the world population is facing water scarcity. Such scarcity of water is urging people to use water from unprotected sources which the world urban poor and rural population are highly affected by. As it is known 'water is life' because it gives life for all, on the contrary many are dying as a result of unsafe drinking water. The objective of this study was to assess the water supply and sanitation situation in the Bishan Guracha. By conducting an assessment one can determine water supply and sanitation coverage and identify water supply and sanitation problems in the sub-city and then propose solutions to improve water supply and sanitation coverage. In this research finding the main defined objective ideas are current water supply coverage, distribution system, water quality, demand analysis at present and future forecasting, analysis the sanitation status, and finally sate the solution for every weak part of the research results specifically. Water supply coverage status 20% water supply fulfills from the water points and the rest 80% of water supply requirement is fulfilled by hand dug well and in some extent rain fall collecting. The quality condition of water supply as WHO and Ethiopian drinking water quality standard both water points and hand dug well water are evaluated. Sanitation coverage is defined as the percentage of the population with access to adequate (improved) sanitation facilities that hygienically separate human excreta from human contact.
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1. Introductions

1.1. Background of the Study

Water is an essential resource for survival and to secure good health. But people around the globe face a problem of water scarcity. As the HDR of UNDP (2006) stated, currently 700 million people in 43 countries live with water scarcity, of these many are in sub-Saharan Africa which represents one quarter of the global population that faces water scarcity live in developing countries. This scarcity of water forced people around the world to use unsafe water for drinking and other domestic uses (WHO, 2009). In schools and in some public places, we are getting familiar with a slogan which states 'water is life". Of course, it is true without which any living things cannot exist, but it would have been better if the slogan is replaced by 'clean water is life' because we have learnt that everyday many people are dying because of water borne and water related diseases. Thus, it is not only the availability of water that guarantees life but it is also its quality. Like water, sanitation is also a basic need and a way to ensure healthy populations. Though having access to improved sanitation is a basic need, it is registered that by the year 2004, 611 million people in urban and 2 billion people in rural area did not have access to improved sanitation (JMP, 2006). Parallel to water, lack of proper sanitation is a serious health risk and an affront to human dignity. Thus, as WHO (2011) stated people are forced to defecate in open fields, in rivers or near areas where children play and food is prepared because they do not have access to improved sanitation.

Even though all human beings have the right to life, the right to education, the right to food…etc, but these fundamental human rights cannot be fully realized unless people have access to potable water and basic sanitation. Independent of the other fundamental human rights, all human beings also have the right to access potable water and basic sanitation (WWC, 2009). Since people in the developing countries are suffering from lack of access to water and basic sanitation, we cannot talk much more about the so-called 'rights' before survival. Thus, the question of having access to potable water and basic sanitation goes beyond rights, rather it is a question of survival.

The question of accessing potable water and basic sanitation also touches sustainable development. The Millennium Development Goal 7 of target 7 can be a simple case to see how important water is for sustainable development (UNDP, 2010). Therefore, any country without assuring access to potable water and basic sanitation cannot realize sustainable development. On the other hand, it is developing countries that are facing the problem of potable water and basic sanitation. Thus, availability of potable water is both a means to attain sustainable development and a symptom of development. That is why many developed countries do not have a problem of accessing potable water and basic sanitation as it exists in developing countries. In other words, poor accessibility

of potable water and basic sanitation is both a cause and symptom for poverty. Therefore, access to potable water and basic sanitation and development are mutually dependent.

Although most areas of our country have sufficient amount of water sources, the sources potential is not yet exploited efficiently. Bishan Guracha is one of these mentioned areas with Un -exploited water resources. This study significantly focuses on improving the water supply system of urban town.

1.2. Statement of the Problem

According to UNDP (2006), in the world almost 2 million children die each year because they do not get a glass of potable water and basic sanitation. And millions of women and young girls are forced to spend hours fetching and carrying water. Sub-Saharan African countries are at the front of the water scarcity problem, one of which is Ethiopia despite the fact that the country has abundant groundwater, major lakes, and large volumes of rainfall (UNDP, 2006). This reminds us what is stated in the same report 'globally there is more than enough water to go around...' but the mismatch between population and water, time variability in rainfall, and, in countries like Ethiopia, limited infrastructure for storage are some factors which have limited equal accessibility of water to all citizens.

Even though water scarcity is a worldwide problem, urban poor and rural inhabitants are at the forefront to be affected by the problem of poor access to potable water and basic sanitation. This is also the situation in rural Ethiopia, where women and children walk for hours to collect water. Many people in rural places walk for hours to collect polluted water from shallow and unprotected ponds, unprotected springs, and rivers, and in some areas they share the same water sources with their animals. All of these sources are subject to contamination as rainwater washes waste from surrounding areas into the sources.

Additionally, young girls spend hours to fetch and carry unsafe water to drink when they are at the age they are supposed to be in school. Because they do not have access to potable water nearby, a girl in rural Ethiopia spend hours fetching water but a girl at the same age in an urban area spends time in school. In addition to the time they spend, as a result of poor access to potable water and basic sanitation, people are becoming unhealthy which leads to lost productivity.

People who have access to unimproved water supply usually obtain from river, unprotected springs and hand dug wells. Specifically when we see water situation in Bishan Guracha town, they have a problem of treated potable water beginning from the past time, until the present time. Bishan Gurach community exposed to a problem of inadequate access of drinking water due to long distance of water point or pure water source, high fluoride contain of ground water in the town and poor sanitation service construction and utilization the facility. In addition to women's are also wastes their time to fetch water from long distance instead participate in women's sector.

1.3. Objectives and Research Questions

1.3.1. Main objective

The general objective of the research is to assess water supply coverage and sanitation through identification of existing drinking water supply and sanitation condition problems in Bishan Guracha town.

Specific objective

- ✓ To evaluate the current water supply and sanitation status in the study area.
- ✓ To assess the main cause of water shortage.
- ✓ To predict the water demand for the next ten years design period.
- ✓ To analysis the current problem concerning about potable water supply and sanitation.

1.3.2. Research questions

In order to achieve the above mentioned research objectives, the following major research questions were designed

1. How much enough the current water supply for all population depends on demand coverage?
2. Does the Bishan Guracha town get water with adequate pressure?
3. How is the current water quality of the town expressed?
4. Can the water supply meet the demand for the next ten years?
5. Do the communities perceive that they have access for water supply and sanitation facilities?

1.4. Scope of the Study

The study will covers assess community water supply and sanitation from identifying main problems concerning drinking water availability to the suggesting possible solutions by using primary and secondary sources of data. This study will be conduct by discussing with Bishan Guracha town administration body, stockholders, key persons and entire communities.

1.5. Limitations and Challenges of the Study

As the thesis is based mainly on primary data from a household survey and documentation from the limited stock in the district, there was reluctance in displaying the list of all community members in the process of selecting a

representative sample from the villages in the sub-city community. The inadequate availability of recorded secondary data about the water supply in the district particularly in the Bishan Guracha sub-city was a limitation faced.

There are a limited number of data recorded in the district office concerning water supply and sanitation. BISHAN GURACHA households have not yet understood the purpose of scientific study and at times they have been confusing our study with that district policy measures and expecting something new to happen after the finalization of the data collection.

The other problems are financial and time limitation due to the lack of fund for this study and have over load by additional courses respectively. Moreover, the study covered only 50 households from entire population of the sub-city communities.

It was a challenge for us to stay in the sub-city community during the data collection to see how people live. Generally, adapting to their way of living, knowing their culture and their status in terms of water supply and sanitation was a huge asset we learned with many challenges.

Finally this thesis reflects a variety of opinions, values and personal experience. Still, it is not possible to represent all different and contradictory opinions expressed by the people who participated during the research. Also the main findings are limited to the answers and translations received by other people and own interpretation. Therefore generalization of findings is only possible to a certain extent, and findings have to be understood in the current context of this research.

1.6. Significant of the Study

This study is expected to increase the knowledge and up to date information for individuals who are interested to study further on coverage, demand, quality of drinking water and sanitation status in study area. Mainly the output of this study data for any interested body, especially researchers who need to deal in the same area. Generally the result will be used for decision making for related development activities that are carried out in the study area furthermore. It will help to draw possible suggestions and recommendations in order to improve status of water supply and sanitation and also quality of drinking water in study area.

2. METHODOLOGY OF THE RESEARCH

2.1. Description of the Study Area

2.1.1. Location of the area

Bishan Guracha Town is found in the Oromia Regional state at the southern edge of west Arsi Zone. The town is situated at a distance of 266 km and 16 km south from Addis Abeba and Zonal capital town Shashemene respectively and 4 km away north of Hawassa City. Astronomically, the town is approximately located between $07^{0}08$' North latitude and $38^{0}48$' East longitudes. (Alemayehu Addunya, 2005). The town has been developing in to as one of important Oromia urban centers since the beginning of 1950's. As to the history of its existing socio-Economic development reveals, it has got its birth from the small scaled formal and informal settlements. The name Bishan Guracha coined from two Afan Oromo words "Bishan" (water) and "Guracha" (black). The name "Bishan Guracha" has got its name from the color of the river which flows from the Wondo highlands to Habaas Lake and bounds the town from the eastern area.

Bishan Guracha is one of the second graded towns in the region which has 997.58 hectares. It is bounded by Shashemene woreda, south nation nationalities and peoples region (SNNPR). Wondo and Shala woreda to the North, South, East and west and west respectively. Based on the proclamation 65/2003 the Urban local government being accountable to the region and the town council is latest progressively emerged by the new reformation system restructuring the town as an independent authority. The town has given the name Bishan Guracha urban local government by proclamation consisting one kebeles. The figure below shows map of the Bishan Guracha administrative town.

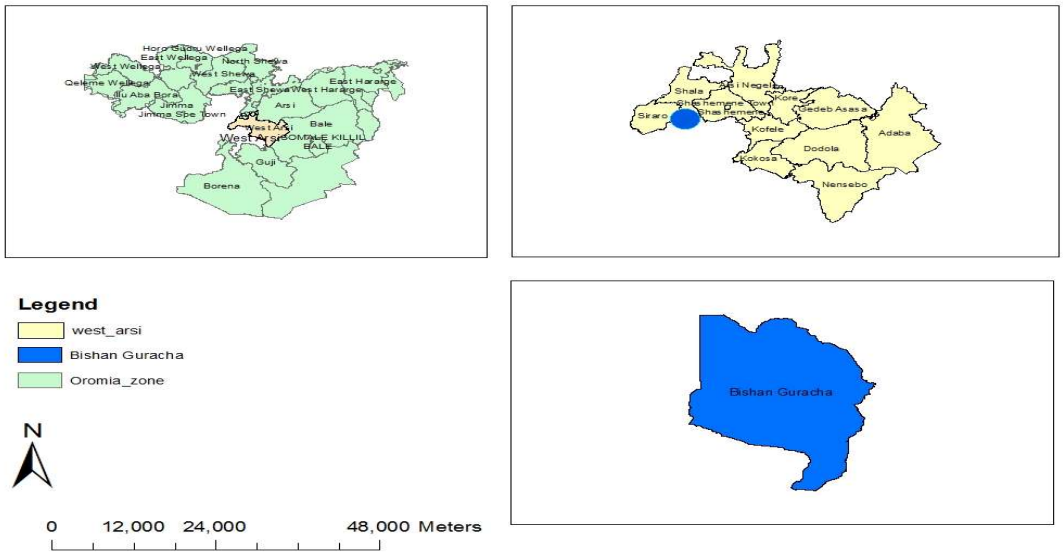

Figure 1: Location map of the study area

2.1.2. Population

The total population of the town is about 20094 according to WAZIUDO socio- economic survey (2011).But the current number of population in Bishan Guracha sub-city was raised to 21420 as the municipal office data source. It is probably the most ethnically mixed town in the region as it composes more than 16 (sixteen) ethnic groups. Unpublished survey conducted in 2011 indicate that, in Bishan Guracha, mixed ethnic groups are founded who are using different languages.

2.1.3. Topography

Topography, Bishan Guracha town is situated at the centre of the Great East African Rift valley which is widely associated with "major danger" seismic Zone (NUPI 1994, cited in Alemayehu Addunya, 1995), hot and humid flat land. Most of the area is characterized by gentle slopes towards Habas Lake, but with a plateau along the north central part of the study area. The elevation of the studied land generally drops to the east, south and southwest direction facilitating the discharge of flood that finally ends up either into Bishan Guracha River or the Habas Lake. The peak altitude is considered to be a little bit above 1,508 meters and the lowest is measured as 1400 meters above sea level. Except fewer scattered plateaus to the west central part, the area is categorized as a flatland surface.

2.1.4. Climate

Climate as a wide team encompassing rainfall, wind, sunshine etc has been recorded for about 30 years. Unfortunately Bishan Guracha Town has not a climatic data of 30 years with its all elements. Thus, we can see the existing year's rainfall data of the town. Bishan Guracha and its hinterlands have the same general climatic characteristics with Hawassaa City. Globally, it is part of tropical climatic region, which is distinguished by its warm temperature, high rainfall and humidity. It also learnt that the study area receives relief/orographix type of rain fall. The town average rainfall for years was 1735.8mm. However, this value seems highly exaggerated as the mean.

2.1.5. Existing water supply and sanitation

According to Bishan Guracha town administration office and respondents feedback potable water supply and sanitation is still lagged to achieve the drinking water supply and pure sanitation of the community. The sources of water supply in the study area for house hold and animal utilization are different source.

Bishan Guracha town community has got drinking water supply from 4 water points, which is installed in the study area. The water source for this water point is that taken from Hawassa town water distribution system. However this water is much less compared to the current demands of town. It only covers 20% satisfies for drinking water demand in the town. Most The households have their own hand dug well. More than 60% their water demand depends on these hand dug well and they use for different purpose such as cooking, cleaning, bathing, washing, and for domestic animals watering. Since the ground water contains high fluoride and other various minerals it is not used for domestic drinking purpose.

On other hand the existing sanitation condition is at lower level. Even if the coverage is more than 70% due to poor hygienic practices, lack of safe drinking water, the town community exposed for different types disease.

2.1.6. Existing water source

Bishan Guracha town has two water sources. These are Bishan Guracha River and springs. Bishan Guracha River: - is the primary affluent and major tributary of Lake Hawassa draining from the eastern part of Lake Hawassa watershed and covering a catchment area of 620 km2. It starts from the small Cheleleka Lake upstream of Lake Hawassa where all perennial and some of the seasonal rivers first drains into before going to Lake Hawassa.. (Yacob Esayas March, 2010). The specific location of the Tikur Wuha River is in SNNPR state in the boarder of Hawassa city which is the capital of the southern region. This river was used for different purposes like irrigation, home use (drinking, bathing, etc). But before few years ago, the stakeholders around the river were stopped to drink from it and mainly used for irrigation purpose. This is because of the establishment of Hawassa textile factory and the factory discharges waste materials or chemicals into the river and contaminated it. Mainly this river is used for irrigation purpose.

On the other hand the current drinking water source is shasha kebele spring source. This is far more than five km from the town. According to the information from Hawassa water supply and sewerage service enterprise the two springs supply permanent discharge for Hawassa town community. The total discharges of the two springs are 55 l/s. During site observation and data collection time the researcher have assess the above sources. The Bishan Guracha town administration told that Oromia regional state set plan and budget to construct water supply project in the coming years from this spring source in order to solve shortage of drinking water supply and poor sanitation for the community.

2.2. Sampling Size Determination

In this case, considering the resources available like time, money & manpower for the study sampling is considered. Depending up on the population studied & socio-economic context & right, selection of sampling techniques is important in order to ensure representative & generalized information required for the study.

The sampling technique used in this study were purposive sampling therefore the selection of sample started with estimation of adequate sample size using convenience sampling technique a total staple size of 78 people were taken from the total population randomly from both kebele.

Beneficiaries are the main primary data sources in this study. In order to ensure the generalization of the findings to larger population, the study was considered adequate sample respondents for selection through appropriate techniques. The numbers of sample households for interview were determined by using the formula developed by Cochran (1977).

Bishan Guracha town has two kebele with a number of total households around 1557 live in it. Both kebele were selected for the sample selection. To determine the number of sample households for interview we use the following formula.

$n' = \frac{z^2 Pq}{d^2}$ ... ---------- (I)

$n = \frac{n'}{1+\frac{n'-1}{N}}$ ---------- (II)

Where, n′ = desired sample size when the population > 10,000
n = №of samples size when the population < 10,000
Z=95 % confidence limit (z-value at 0.05 is 1.96)
P= 0.05 (proportion of the population to be included in the sample i.e. 5 %)
q= 1-0.05 i.e. (0.95),
N= total №of population (1557) and
d= margin of error or degree of accuracy (0.05).

2.3. Methods of Data Collection

To extract the required information needed to meet the objectives of the study we used both primary and secondary data. Under primary data we have four major techniques were employed in the study: household survey questionnaires, key informant interviews, focus group discussion, personal observation and secondary data or document review.

- **Household Survey**

As Bryman (2008) noted, in order to reduce the error due to inconsistency of interviewers, structured interview or questionnaires designed by the researcher distributed to three trained interviewers and/or research assistants. These three research assistants taken from the local communities were very familiar with the language and culture of the community. So the respondents did not face any difficulties concerning language and unintentional disgracing of culture. The sample respondents were selected by systematic sampling. The systematic sampling applied to 1557 households of Bishan Guracha town from which 78 sample households selected.

- **Focus Group Discussion (FGD)**

The researcher utilized FGD, which the group formed on purposive sampling. Generally, as Bryman (2008) noted the focus group has enabled the researcher to address the opinion of the community towards access to potable

water and basic sanitation and its impact on their daily activities. Therefore, the researcher created four groups based on age and gender basis: older women, older men, young males and young females.

- **Key Informant Interview**

There are main actors in the supply of potable water and basic sanitation. The district water desk officers and the community HEWs have direct contact with the community in providing them with access to potable water and basic sanitation, and creating awareness. Thus, the researcher has addressed these groups of individuals using personal interviews on what has been done to help the community to get access to potable water and what has been done to reduce the communities vulnerability to water borne diseases and how the poor accessibility is affecting the well-being of the community.

- **Personal Observation**

The researcher has used observation as an additional means to the data collection which helped to have a general understanding of the area and how the community perceives the environment, to what extent the community is aware of the right to water, and how poor access to potable water and inadequate sanitation affects the livelihood of the community.

Additionally, the researcher has observed the activities of the community which may reduce their vulnerability to water borne disease and negative impacts of poor sanitation and unsafe Drinking water. Since observation comprises subjective judgment the researcher did not completely depend on the results of the observation in the empirical finding and analysis part of the study unless supported by the other data collected by other means.

- **Document Review**

In addition to the primary data, the researcher has tried to collect written documents from the district, reports and publications on potable water and basic sanitation worldwide, in Africa and Ethiopia to see the rank of Ethiopia, as supporting means of the data collected by the primary sources.

2.4. Data Analysis and Processing

Data analysis is the process of evaluating data using analytical and logical reasoning to examine each component of the data provided. This form of analysis is just one of the many steps that must be completed when conducting a research experiment. Both qualitative and quantitative data were gathered through questionnaires, interviews, and personal observation and secondary data from relevant document were reviewed and then analyzed by word description and other methods to form some sort of assessments or conclusion. EPANET-2, laboratories tests, charts, graphs, and table were useful tools in this research to analyze the row data.

- **Analysis of the general background of the respondent**

The key issues obtained from the respondents are; education, occupation and household size highly determine the water use and demand in the households and the extent to which the households get involved in sanitation and hygienic issues.

- **Analysis of the current water supply status**

From the data we have directly gathered that the current water supply condition was leads to sever problem .The data was gathered using house hold survey and key personal interviews. The response states in quantitative way that water used per person in Bishan Guracha is about 12l/c/d which are less in quantity, but in average water consumption per household as the respondent told us for about 60 l/HH are used in daily this achieved only when the water points on service but the water points servicing time is limited due to in accessible of the water it may also stop the service up to 2 weeks.

- **Analysis of distribution system of the Bishan Guracha**

As data collected from the municipal office of Bishan Guracha sub-city have done the pressure distribution and the alignment of the site using software called EPANET-2.The data collected necessary to run the program was length, diameter, and roughness for the pipe and elevation and base demand for the junction (nodes) whereas elevation, initial level, maximum level and diameter for the reservoir and finally the head at the source level was necessary. By inserting hose data to the software EPNAT-2 it can easily done the required task.

The water quality both the water points and the traditional hand dug well was analysis by checking their physical and chemical characteristics in some extent. The producers to do this were collecting the raw water from both water sources as a sample.

Procedure: - 1. Fill one-fourth of the 1000ml of beaker with sample.
2. Rinse the instrument into the beaker.
3. Read the value of water by using the graduations.

Temperature: checked by thermometer

PH:-PH meter because of the only available material is it in this lab house.

Turbidity:-

Apparatus:- Palintest Turbidity Tube, 13” (PT 514) or Palintest Turbidity Tube, 28” (PT 528)

Conductivity:-

Apparatus: Self-contained conductivity instruments, Thermometer, Conductivity cell.

TDS=is ½ of conductivity.

- **Water supply demand analysis for the current to the future**

Population forecasting:-Several technics are appropriate for the projection of population for the next design years. From the different methods the Ethiopian statistic authority uses the formula $p_n=p_oe^{kn}$ for most water supply project in the country to project population at the end of required decade/year.

$P_n=p_oe^{kn}$

Where p_n=population at n decades or year

Po=initial population (from census)

K=growth rate n =decade

Source: (Federal Republic of Ethiopia Central Statistical Agency population projection figures no dated).

Domestic Water Demand

The water demand for actual household activity is called domestic water demand. It includes water for drinking, cooking, bathing, washing, flushing toilet, etc. The demand depends on habits, social status, climatic condition, mode of service and above all on the price of the water and affordability of the users. For this scenario the domestic demand categories is only Public fountains (PF).

In projecting the domestic for Bishan Guracha, the procedures are as follows:

I) Population percentage distribution by mode of service
II) Establishment of per – capita water demand by purposes for each mode of service
III) Projection of consumption by mode of service
IV) Adjustment to climate and socio – economic activity
V) Projection of domestic demand

Maximum day and peak hour demand

The size, mode of service and social activities of the population in the study area significantly influence the peak hour demand. The projected water supply was done based on the population size the study area of the maximum daily factor of 1.3 and a peak hour factor of 2 is taking for this scenario, because the area of the population is also greater than 10,000.

- **Analysis of sanitation status**

Based on the proposed questions distribute to the respondents and gathered all the necessary information about the current status of the Bishan Guracha sanitation condition. To evaluate the sanitation status we have used both the respondents answer and by field observation.

3. RESULT AND DISCUSSION

3.1. Sample Size Determination

Table 1:-sample size identification from each kebele.

Bishan guracha administration sub-city	Kebele one	Kebele two
Sample size	39	39

3.2. General Backgrounds of the Respondents

Table 2:-General Background of the Respondents

Respondents back ground		Frequency	Percentage
Gender	Male	50	65%
	Female	28	35%
Age	20-30	23	29.5%
	30-50	37	47.5%
	>50	18	23%
Education	Primary	26	33%
	Secondary	14	18%
	Collage	25	32%
	Never been to school	13	17%
House holed size	1-5	41	52.5%
	>5	37	47.5%
Main occupation	Farmer	11	9%
	Daily labor	4	3%
	Government employee	44	34%
	Small scale business	41	32%

An understanding of these can help the researcher to see which areas are critical for enhancing water supply and sanitation schemes. About more than 70 of respondents were in the economical productive or 25-64 age

bracket. That means data was gathered from the productive age group and indeed people of this age group are those expected to take actions in the development processes of the town water supply and sanitation.

Among the backgrounds in Table 4.1, the following variables education, household size, main occupation are believed to determine the water use and demand in the households. It is logical that the increase in household size will increase the demand for water. The collected data also show that as the household size increases the demand for more water increases. As the researcher simply comprehend from the collected data, households with 1-5 members need a maximum of 80 liters of water per day; on the other hand households with 6-10 members need a maximum of 120 liters of water per day. Thus, this variation in the liters of water needed per day shows that the household size determines the liters of water need per day. This means that as the size of Households Increases, The Amount of Water Needed per Day Increases.

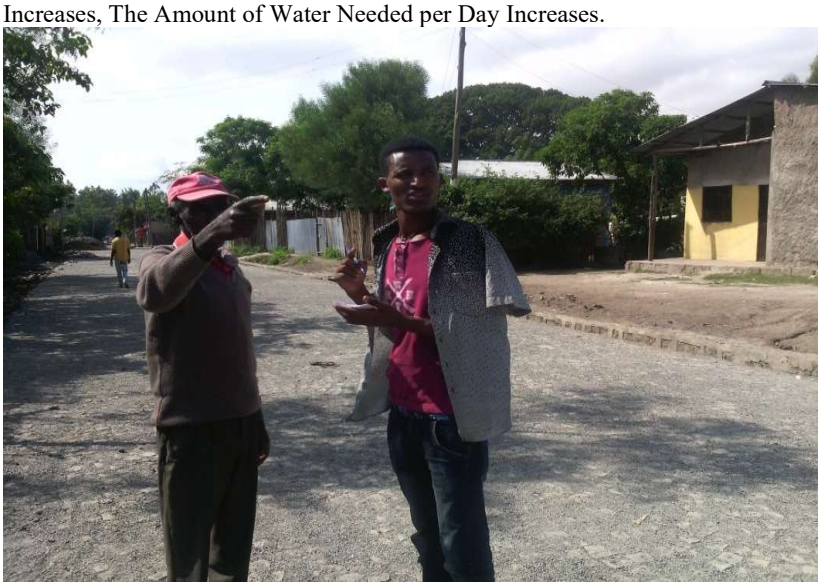

Figure 2:-Interview on Household Survey

3.3. The Current Water Supply Statues in Bishan Guracha Sub-City

3.3.1. Water Sources for Drinking

More than half of the populations in the community use water from unprotected traditional shallow hand dug wells for cooking, washing and other household activities as their main source. In addition to the traditional shallow hand dug wells the community members have access to spring water source for drinking and for other domestic use which is emanated from Shasha kebele Hawassa city water supply source which accounts for all the community. Though, only limited numbers of the community members are lucky to get access to spring water, due to un-proportion number of water points and the population density around the water points is far apart. The rain water is another source of water for drinking and other household activities. Rainwater runoff from roofs can be collected and stored for drinking and other household activities but this activity is only seasonal. Unless the rain water is affected during collection, it is believed to be of good quality and the only source of contamination is airborne microbes that exist in very small amounts. Likewise, in the community the rain water is perceived to be the cleanest water. The statistics gathered from the respondents show that only 20% of drinking water supply is fulfilled by the 2 water points. More than 60% their water demand depends on these hand dug well and they use for different purpose such as cooking, cleaning, bathing, washing, and for domestic animals watering.

Table 3:-Household Comments about the existing water supply in the town

According to the respondents information most of the households got inadequate drinking water from water point.

Consumers comment to service level	Number consumer	Percentage
Adequate	12	15.3%
Satisfactory	20	25.6%
Inadequate	46	59.1%


Figure 3:-source of traditional hand dug well and water point respectively

4.3.2. Distance from the Water Points

Almost all of the populations obtain their drinking water from the 4 water points which have an average of 500m distance from 1 water point to the other water point. The number of visits to the water sources depends on the amount of water they require per day. Thus, the questions how many liters of water do the households use per day and how far the sources are from their houses are two important questions which need answers. According to the data, 95 percent of the people in the community need a minimum of 40 liters and a maximum of 80 liters of water per day. The water used per person in Bishan Guracha is about 12l/c/d which is much less in quantity when we compare to both the globe and Ethiopian drinking water standards, but in average water consumption per household as the respondent told us for about 60 l/HH are used in daily this achieved only when the water points on service but the water points servicing time is limited due to in accessible of the water it may also stop the service up to 2 weeks.

In order to fetch this much water, people have to go to the water source at least twice a day. The distance from the water source takes a minimum of 5-10 minutes for those nearby to the water sources which comprises 24 percent of the total population. But as the data show, more than 60 percent of the community has to walk for more than 25 minutes to fetch water from the sources. This much time is just for one trip but as many in the community want to have 40 or more liters of water per day this obliges them to walk for almost an hour.

Table 4:- Distance from the Water Source

Time taken	Percentage (n=78)%
5-15 minute	12
15-25 minute	16
25-35 minute	35
>35 minute	37

On average to fetch water in one round from the sources listed above, it takes 26.3 minutes and if they have a donkey, they can handle 40 liters of water in one round; if they don't have they only can handle 20 liters of water at once. Thus, they are expected to return to fetch the other 20 liters of water which means it takes more than 50 minutes to collect 40 liters of water. In order to fetch these amounts of water, some who has donkey do not carry the jerikan (container) on their back because their effort limited to fill up the water into the container at the water source. Otherwise people have to carry 20 liters of water on their backs from the source to their houses which takes almost one hour to collect the minimum of 40 liters per day. Therefore, all the household members have to visit the water sources as many times as possible to satisfy their water needs. On the other hand, the distance from the source determines the amount of water they can collect. As the JMP (2006) stated if the distance from the source is 30 or less minutes to reach to and get back, most of the householders at least fetch enough drinking water to satisfy their basic needs. But if it takes more than 30 minutes, people collect less water than they need to meet their basic needs. Thus, as the table 5.2 above shows there are many members of the community whose water needs per day are determined by the distance to the water source.

Figure 4:-Mechanisms of Fetching Water

The responsibility of collecting water in the community is almost given to women.

Table 5:- Responsible to Fetch Water in the Household

Responsible to fetch water in the household	Number	Percentage
Mother	30	38.5%
Daughter	35	44.8%
Son	10	12.8%
Father	3	3.8%

3.4. Distribution System of the Sub-City

The average elevation of the source was 1700m above sea level and this water distributed to the sub-city water points 4 with 2 junction places at the average elevation of 1554m above sea level. Their fore the distribution method can be gravity distribution. The water is flow with pipe diameter of 40mm at the BM and the type of pipe used is HDPE, and GS. The total current water supply discharge for the town was calculated by using Bernoulli's Equation:

$$Q=AV=\Pi r^2 *V \quad \text{---------- (I)}$$

Where, Q= Current total discharge

V= standard flow velocity (take 0.6m/s)

r= radius of the pipe (20mm)

When we look the water losses it is not that much serious cause and it is not necessary to consider at this assessment. The total daily water consumption of the community at the current time was 65.14m^3/day.

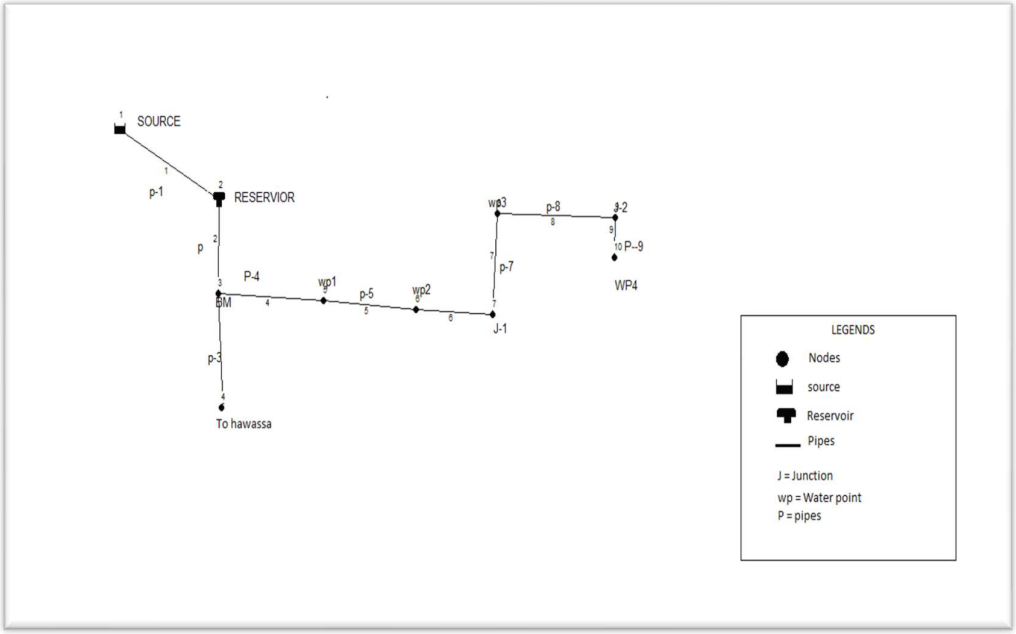

Figure 5:-Water Supply Distribution for Bishan Guracha Sub-City

Figure 6: Cross section of Bishan Guracha Water Supply Pipe on Tikur Wuha River

As the distribution shows that the networking system was series connection system.as the results indicates that the pressure distribution is positive mean that the flow can reach accurately for the water points using gravity distribution method.

3.5. Water Quality

3.5.1. Physical-Chemical Parameters

Table 6:-lab Result of Physical properties

Drinking water quality standards	Physical characteristics of drinking water				
	PH	Turbidity (NTU)	Conductivity µs/cm	TDS mg/l	Temperature T^O (C^O)
WHO guide lines	6.5-8.5	<5	10-1000	1000	<15
Ethiopian standard	6.5-8.5	-	-	1000	
WP1	6.59	0.58	252	126	24.8
WH2	5.87	4.37	865	432.5	24.8

Key: WP=water point, WH=water hole

Public fountain and hand dug well water quality

- **Color, odor and taste**

The water point physical parameter is safe against color, odor and taste this is checked by observation, smiling and by testing the taste. On the other hand the hand dug well it is not safe against the above physical parameters or terms.

- **Temperature**

The result showed that the temperature of 24.8ºc from Bishan Guracha water point and hand dug well lab result indicate that temperature was above the permissible limit of 15$^{o}_{C,}$ which is recommended by WHO (2006). Temperature is one of the physico-chemical parameters used to evaluate the quality of potable water. When water temperature increases, disinfectant demand and microbial activity will also increase so that palatability of water quality decreases (Collick etal., 2008). Therefore, in order to reduce the level of biofilm formation and to make pipe water potable, controlling water temperature is very crucial. These cold be done either through increasing the pipe thickness, buried pipe system than laid over the surface and underground storage systems.

- **Turbidity**

The turbidity level of Bishan Guracha water samples (0.58NTU) was compliant with WHO of less than 5NTU (WHO, 2010). However,). However, the mean turbidity recorded of hand dug well (5.85NTU) did not meet the standard. The measurements showed significant variations amongst water samples from water point and hand dug well of bishan guracha sub-city. This may be due to human and animal wastes polluting the water source of hand dug well since it has no fence, cattle trough, no protected in any means as it was observed during field visit. Turbidity of water is one of the important physical parameters that affect not only the quality of water, but also the quantity. According to Momba *etal* (2006) turbidity was the most common indicator of water quality. High turbidity indicates the presence of organic suspended material, which promotes the growth of micro-organisms. Turbidity was chosen as a parameter for its correlation with potential microbial problems.

- **PH**

The mean PH value of hand dug well and water point is (5.87) and (6.59) respectively. From this water point meets

both the drinking water standard WHO and Ethiopian standard which recommends being 6.5-8.5.but the hand dug well is out of the range or not fulfill the standared.PH value beyond the limit causes a progressive decrease in the efficiency of chlorine disinfection. Consequently it is suggested that pH adjustments to water within distribution systems could reduce or control biofilm growth (Meckes, 2000).

Generally depend on water quality parameters the laboratory result of Bishan guracha water quality is not clear specially dug well water is more polluted as we see the lab result and physical characteristics of the sub-city drinking water. To recommend the quality of drinking water we compare the lab result of Bishan Guracha water with the standard value of drinking water quality as WHO and Ethiopian recommended quality standards. This water quality is one cause of disease for the population like typhoid, teeth color, ameba are most habitual disease comes due to water quality problem. This is chick by asking clink professionals and personal interview that damage by the disease.so to protect the population of Bishan Guracha sub-city from this disease due to quality of water first create awareness to treat water before drinking specially the hand dug well water using chlorination, boiling, distillation, screening systems are temporarily good.as permanent proper drinking water points must be constructed as per capital water demand of the population and all the people must be use the treated pure water.

3.5.2. Measures to Increase Water Quality

The treatment condition of water in the Bishan Guracha water supply system is generally dominated by Hawassa town means the treatment activities are generally takes place in Hawaasa but in Bishan Guracha there is no treatment.

As we have seen from the field observations, the hand dug well water quality is perceived as bad and very bad by 75 percent of the community but how many of them treat the water to make it safer to cooking, washing, matters most since they do not have alternatives. Hence, as the researcher asked the sample respondents, only 19 percent of them treated the water to make it safer for cooking and washing. The methods of water treatment includes boiling the water, adding tablets, straining it through cloth and letting it stand and settle. Such treatments may not make the water absolutely safe to use but it gives relief at least in the eyes of the one whom uses it. As data show, boiling the water takes the highest percentage and the easiest to apply. For some of the community members adding the tablets may have some negative implications because they believe that the tablets given to them may not be a means to treat the water, as a result many are reluctant to apply it in their usage water. It is well understood that the treatment of water at home minimizes the exposure to water borne diseases; but it is neither a guarantee for great health benefits nor a replacement for a sustainable potable water infrastructure (JMP, 2006).

3.6. Design of Water Supply and Projection for the Next 10 Years

3.6.1. Population Projection

According to Ethiopian statistic authority formulas of population forecasting uses the formula $p_n=p_oe^{kn}$ for most water supply project in the country to project population at the end of required decade/year.

Table 7:-Population Projection for the Next 10 Years

Year	Growth rate	Projected population
2008E.C		21420
2013 E.C	4.3%	21885
2018 E.C	4.3%	22361

3.6.2. Water demand

Domestic water demand

I. Population distribution by mode of service

Table 8:-Population Percentage Distribution By Mode of Service

	Year		
Modeof service	2008	2013	2018
Public water points	100	100	100

II. Establishment of per- capita water demand for each mode of service

A per-capital water demand, for any mode of service is determined by adding the water requirments of the use of different purposes.The values as per the recommendation in the design criteria are presented in the table below.

Table 9:-Consumption of per- capita water demand in 2001 (l/c/d)

No	Activity	PF
1	Drinking	2.5
2	Cooking	4.5
3	Ablutions	7
4	Washing dishes	4
5	Laundry	7
6	House cleaning	2
7	Bath & shower	2
8	Toilets	
9	Total	30

The above values in the table shall be used in the base year of the design horizon.

The above table per capita demand is for 2001. People as per improved living standard, their water consumption will incrceases. However, up to now there are no investigation or studies made in Ethiopia regarding the consumption growth rates for the different demand categories.

Taking in to consideration of the demand growth rates of similar town project and making some adjustment with respect to particular case of Bishan Guracha sub-city the per capita demand values at 2001 for each category .

We adopted growth rate of 1.2% for public tab users considering th above assomption the projected per capital water demand from 2001 on wards is shown below .The projection done by exponintial method.

Table 10:-Projected Per Capita Dimestic Water Demand By Mode of Sevice (l/c/d)

Mode of service	GR(%)	Year			
		2001	2008	2013	2018
PTU	1.2%	30	32.62	34.65	36.9

III. Projection of consumption by mode of service

Table 11:- Projected population by mode of service

	Projected population								
Year	2008			2013			2018		
Mode Of Service	Population Distribution By Mode of service Service	Total Population	Projected Population	Population Distribution By Mode of service Mode of service	Total Population	Projected Population	Population Distribution By Mode of service	Total Population	Projected Population
PF	100	21420		100	21885	21885	100	22361	22361
Total	100		21420	100		21885	100		22361

Table 12:- Projected average domestic demand

Mode of service	Projected daily average domestic demand(l/d)								
	Year 2008			Year 2013			Year 2018		
	Projected population	Projected per capita water demand	Projected average domestic demand	Projected population	Projected per capita water demand	Projected average domestic demand	Projected population	Projected per capita water demand	Projected average domestic demand
PF	21420	32.62	698720.4	21885	34.65	758315.25	22361	36.9	825120.9
Total add(l/d)			**698720.4**			**758315.25**			**825120.9**

IV. The adjusted domestic water demand

Table 13:- Water Demand Analysis for Design Period

Description	Unit	Water demand analysis for design period (year)		
Year		2008	2013	2018
UADWD	Liter/day	698720.4	758315.2	825120
climatic factor		1	1	1
socio economic factor		1.05	1.05	1.05
AADWD	Liter/day	733656.4	796231.0	866376

3.6.3 Maximum Day and Peak Hour Demand

The size, mode of service and social activities of the population in the study area significantly influence the peak hour demand.

Table 14:-Recommended Water Demand for Peak Factors

Population size	Maximum day factor	Peak hour factor
2000	1.3-1.5	2.6
2000-10000		2.4-2.2
10000-50000		2.2-1.8
50000-80000		1.8-1.7
80000	1.2	1.7

Table 15:-Average and Maximum Day Water Demand (m^3/d)

Parameters	Unit	2008	2013	2018
Average day demand	m^3/d	698.720	758.315	825.125
Maximum day demand	m^3/d	908.336	985.81	1072.66
Peak hour demand	m^3/d	1397.44	1516.63	1650.25

3.7. Sanitation Status of the Bishan Guracha Sub-City

3.7.1. Toilet use and accessibility

Table 16:-Toilette Accessibility at Bishan Guracha Sub-city

Item	Toilet used (%)	Toilet unavailable (%)
Sample population(n=78)	83.7%	16.3%

The data collected from the sample respondents shows that 83.7% percent of the community has a toilet; even those who have a toilet, most of the toilets do not have any facilities. They are just simply made of digging a hole in the ground down and putting some woods on it. Among the 83.7 percent of the population with toilet, 19 percent of them share the toilet with other households. But the rest 81 percent do not share their toilet with other households.

Those who do not have toilet which means 16.3 percent of the community defecate in an open air field, near river, and in a place where far from their house. Among these 16.3 percent of the population, 61 percent of them defecate in an open air field, 23 percent and 16 percent of them defecate in place far from their house and near river respectively.

3.7.2. Disposal of Solid and Liquid Wastes in the Study Area

According to municipality officer response there is solid waste disposal site out of the town. This is excavated hole and fenced with wire in order to prevent the five major diseases for human and animals. But in the study area most of the householder does not used properly the solid waste site for disposing liquid and solid waste, due to the distance from the households. As the respondents of health center, households told that the Bishan Gurach town administration give attention to address the sanitation condition of the town and discuss with the community in order to solve sanitation problem.

The main source of solid waste is domestic refuse. Because of lack of awareness how to handle the refuse the household vicinities were found to be full of solid wastes (garbage's) scattered all over. Considerable number respondents did not use the proper way of disposing the waste which is unhygienic and responsible for spreading diseases. The condition is, therefore, likely to present a high risk for the continued transmission of communicable diseases despite the efforts made by the town health office to alleviate the existing solid waste management problems. This was able to indicate the condition of environmental sanitation in Bishan Guracha mainly in relation to water supply and sanitation. The situation in most cases was very poor. There is a need to educate the people to dispose of the waste in proper places.

Figure 6:-Solid Waste Disposal of the Community

This type of disposal system of west products is open to atmosphere and also open to washout by rain water it leads to cause of environment pollution and dug well water pollution. To protect this pollution problem due to disposal system of west products formal disposal system must be recommended like preparing well to insert underground as much as possible out of county and in elevated place to protect from washout or erosion to recharge ground water.

3.8.Factors Hindering Access to Potable Water and Basic Sanitation

When respondents were asked if they know why they do not have get access to potable water and basic sanitation, they forwarded the following reasons. Some of the factors given do not have any scientific grounds which may not be sound reasons in professionals' point of view.

These factors are discussed in the following paragraphs.

- **Ground Water Resources**

It is known that ground water resources are a source for many hand dug wells in Ethiopia. The community members believe that one of the reasons which do not enable them to have access to potable water is the quality of ground water resources. Though the community thinks so, the district water desk officer said, these kinds of projects failed because they did not have accurate pre-feasibility studies. Thus, this lack of studies does not indicate whether the districts ground water resources quality is safe or not. In contrast to the community's thought, the former minister of the Ethiopian MWR stated that in spite of is quantity and quality, ground water is believed to be available throughout the country though he believed 'the use of groundwater in Ethiopia is hampered by a lack of understanding and information" (Dingamo, 2008).

- **Administration Problem and Less Capability of the Communities**

Administration problems of the peasant association and the district administration were also identified as additional hindering factors preventing access to potable water and basic sanitation. People in the community believe that the communities do not have any influence on the district to focus attention on this sever problem. In addition, some said the district administration has a problem of allocating the budget equally to all programs.

Some other groups also believe that people in the community do not have the capability to do anything concerning water and sanitation than drinking the water they get nearby and defecate in a place which they think is appropriate.

- **Budget Shortage**

According to the district water desk officers, there is always a budget shortage to do what is planned to the Bishan Gurach communities especially with water and sanitation at the beginning of the year. Though the district has a plan for constructing at least one water points in each kebele, these plans can't be realized because it does not have a sufficient budget to implement it.

4. Conclusion

Generally the water supply and sanitation status of bishan guracha sub city is unsatisfactory means that the current water supply for the community is not enough or the coverage of supply to the demand unbalance. The present population number is above current water supply availability in present the coverage is 20% the rest of 80% is use

traditional hand dug well water. When we see the peak hour demand of the current population is 1397.44 m^3/d but the current water suuply service is 65.14m^3/d this result indicates that how much unbalance in between demand and supply .the current water supply as the respondents informed us 12l/c/d but according to Ethiopian water supply standard everybody gets the demand of 30l/c/d.

The qualities of hand dug well water and water points as different parameter perspective is checked by laboratory results and compare the result with WHO and Ethiopian drinking water quality standards. Stands from this water points water quality is safe but the hand dug well water is not safe as the lab result indication.

There are 4 water points exist in bishan guracha sub-city out of this 2 of them are out of service the only 2 water points give service to the community. Even if this 2 water points exist the service is not continues. The serviceable water points averagely stop the service 2 up to 4 days per week. This leads to the shortage of water create in community. To dug out this shortage of water the population use traditional hand dug well. But the laboratory result indicates the quality of hand dug well water is poor this leads to water born disease to population.

When we see the distribution system it is gravitational flow from source to the water points in series alignment. The pressure distribution status also safe throughout the network system as checked by software called EPANET-2.

The Sanitation status of the sub-city is poor and there is no formal way of disposing the waste products it leads to the pollution of environment by odor, air pollution, hand dug well pollution are some of the problems comes due to poor sanitation activities.

Generally the main cause of poor sanitation and unsatisfactory status is due to awareness of the population, unsmooth relationship of stakeholders ,economic status of community, luck of skill full person, the weakness of official leaders of the sub-city are the most factors.

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