Addis Ababa University
School Of Graduate studies
College of Development studies

Assessment of the Challenges and opportunities of water supply in Condominium Housings of Addis Ababa

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A thesis submitted to Addis Ababa University School of Graduate Studies Centre for Water and Development in partial fulfilment of the requirement for the degree of Master of Art in Water & Development

Addis Ababa, Ethiopia

June, 2013

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

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DECLARATION

I declare that this Thesis is my original work and has not been presented for a degree in any other university and that all source materials used for the Thesis have been duly acknowledged.

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ACKNOWLEDGEMENT

First and foremost, I would like to thank Lord God Almighty for giving me the strength and courage to go through all this work. God, I praise you forever. I would like to express how grateful I am to Dr. Yohannes Aberra, my research advisor for his remarkable role in giving constructive comments from the very inception of the work and guiding me throughout the study. His insightful comment for the betterment of the whole work was appreciable.

Much credit also goes to my ever supportive wife W/ro Wubiet Kesela for her assistance needed to complete the study and to my dearest little daughters, Christy Desalegn (Hagerunate/ YesmaGojjam Desta) & Tensaie Desalegn (Little flower-Tibeltalech Desta). You all are the greatest blessing in my life. I don't know what I would do without you. I love you all and thank you very much.

I owe an even much debt to my beloved family: my mother Kassaneshe Bayehe for her invaluable encouragements and supports starting from my childhood until present and for my brothers Mognet Yehouala and others for their over all support.

My special thanks also go to Tigst Kesela and Hana Kesela and to my friends Yekoyealem Desie(for his constructive comment during proposal writing), Tefie Dergaza, Mekuria Tsegaye, Mentewab Alula, and to those unmentioned friends for their remarkable help in my study and during my field work in Addis Ababa.

Finally, all other people who helped me during the study are also acknowledged. I am especially thankful to residents of condominium houses who responded to my numerous questions with remarkable patience.

Dedicated

To My Beloved Parents

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Acronyms

AAWSA:	Addis Ababa Water and Sewerage Authority
CSA:	Central Statistics Authority
FGD:	Focus Group Discussion
GoE:	The Government of Ethiopia's
IHDP:	Integrated Housing Development Program
MDGs:	Millennium Development Goals
MWUD:	Ministry of Works and Urban Development
NGOs:	Non-governmental organizations
SPSS:	Statistical Package for the Social Sciences
USD:	United States Dollar
UNICF:	United Nations Children's Fund
WB:	World Bank
WHO:	World Health Organization

ABSTRACT

This thesis assessed the challenges and opportunities of water supply in condominium housing of Addis Ababa. A survey of 200 households from the study area coupled with information by interviewing officials of AAWSA & filed observation revealed the nature of problems of water supply. The major problems of previous residence water supply were water interruption & quality problems, irregular timing in water distribution, water purchase from water vendors, pipe line breakage, walking long distance and long queue for water fetching. On the other hand, the previous residence water supply situation had opportunities of having clean and enough amount of water, availability of water any all the day and time. In condominium housing units, Water supply interruptions, inadequate water supply, Sanitation, requirement of additional man power for water collection are the major problems. The other problems identified are, work load of women in the households, drainage & sewer pipes busting and blockage, high water prices from water vendors during interruption, children risk their lives crossing roads in collecting water. This is due to inadequate waters source, inadequate finance, and inadequate man power, weak coordination among offices, rapid population growth, absence of resident's participation and some other challenges in the study area. Employing appropriate technology, financing water supply projects, Integration between institutions and different sectors, developing water sources that fit with the growing population and urbanization are the major copping strategies for the challenges that the author recommended for reversing the existing challenges and in achieving more efficient provision of water supply in the study areas.

Key words: *Water Supply, Condominium housing, Addis Ababa.*

Chapter One: Introduction

1.1. Background of the study

The development of condominium housing is intended to solve many problems of the urban residents. It enables to fulfil and solves basic problems like water supply, sheltering, and other infra structures (toilets, Kitchen, waste water Solid waste collection, etc) of the dwellers. Many countries in the world started this program because of social, financial and economic rationales.
In the trend of overpopulated cities, condominiums built since 1960s have became main dwellings for many citizens. Firstly, these buildings were four or five-story prefabricated concrete blocks, sitting on shallow foundations that their styles and building technologies came from Soviet Union. In Vietnam, since 1995, the boost of country's economy creates flows of people pouring into cities for new jobs and better living conditions. Many high-rise condominiums of 10-30 stories were constructed in new townships to accommodate these new residents. These new condominiums provide better living conditions for occupiers comparing with those built in 1960s and 1980s in terms of safer designs, more suitable layouts of individual apartments with local demands (H. Dinh Tuan, 2007).
The government in Armenia also directed its local authorities for supporting condominium development nationwide in May 1995 and Vilnius and Lithuania, started this program in October 2001 (World Bank, 2008). Japan also constructed this kind of houses in 1998 (H. Michiko , 2008).
In Africa, countries like Uganda in its capital Kampala (M.C. Richard, 1998) and some other countries like Ethiopia launched this program. The idea of condominium housing is a new phenomenon in Ethiopia. The Addis Ababa city administration launched low cost condominium housing projects through the Integrated Housing Development Program (IHDP) in 2006 to minimize housing backlog, slums, and to provide decent shelter to middle and low income groups (MWUD, 2008). It is also emerged as a strategic response to rapid urban population growth, high prevalence of urban poverty, and urban unemployment in major Ethiopian cities by facilitating the entire infrastructure including water supply (MWUD, 2006; IHDP, 2008).

In 55 cities across the country about 400,000 condominium houses are going to be constructed (UN-HABITAT, 2011; Hayal, 2008; REAL CORP, 2008). According to the 2012 report of the research, planning and budget department of the housing development project office, so far, 80,245 condominium housing units have been constructed and transferred to beneficiaries and 67,000 houses are under construction in Addis Ababa city.

Along with the construction of these condominium/multi-storey/ houses, the city government is constructing basic infrastructure. However, as Minwuyelet (2005), in Addis Ababa, the degree of the physical expansion of the built-up area of the city has outpaced the capacity of the city government's infrastructure and basic urban services, like water supply have remained a problem in the newly constructed areas. In line with this, Azeb (2006) also indicated that greater proportion of the Addis Ababa residents have less access to basic services and amenities such as safe water, sanitary, health and similar facilities.

1.2. Statement of the problem

As one of the cities in the developing countries, Addis Ababa is currently experiencing huge expansion in condominium housing construction though the basic needs of the dwellers (e.g., housing, water and electricity supply, transportation, etc) remain unmet. In these kinds of houses the issue of water supply is crucial. For that reason, expansion of water supply infrastructures in the newly establishing condominium housings becomes mandatory. Because water is the basic necessity for human survival; despite it remains critical problem in most of the cities of developing countries including Addis Ababa.

Therefore, the Addis Ababa Water and Sewerage Authority have been struggling to satisfy the demand for water in the city (Mahlet, 2011). Even though, there is expansion of the water supply facilities by AAWSA, currently, Addis Ababa is expanding rapidly both in its urban construction (like condominium housings) and share of the population with access to clean water. Therefore, meeting the need for these newly constructed condominium houses is a serious challenge to the city administration.

Supplying water for condominium housings involve serious challenges and opportunities as compared with conventional houses. Wubshet (2008) explained that in condominium housings one of the basic challenges is the drainage and sewer pipes are frequently busting and blocked because they are failing to cope with increasing pressure of population. The other challenge is leakage problem which is typical for condominium housings as compared with conventional housings. Residents of condominium housings are also heard of repeatedly complaining the water supply of their houses in that the amount of water is not enough and also is not reaching to the third and forth floor. This creates additional burden on women's to collect water from somewhere.

In this regard, M. Oldenburg, F. Meinzinger, A. A. Lisanework, K. Gutema, P. Krusche, O. Jebens, (2009) asserted on their study of the experience with the introduction of dry, urine diverting sanitation systems in Ethiopia that, the multi-storey buildings regularly face problems related to water-supply and wastewater management. Water supply is irregular, which makes the use of water-flushed toilets inconvenient. Lack of transporting and treatment facilities for septage pose hygienic risks to people and the environment.

On the other hand, the move from conventional housing type to condominium housing program is not out of opportunities. As J. C. Melo (2005) pointed out condominium design contemplates the decentralization of the drinking water supply or sewerage treatment facilities to avoid the costs associated with transportation of fluids over long distances and no need of the public network to run through every plot of land as like conventional houses.

In addition, that the model of the condominium house project provides all sites with drainage and sewer pipes (Wubshet, 2008). Besides, residents living in condominium housings have individual connections /Private tap with in the unit/ in their homes and get a better supply of water i.e., access to Safe and clean water. Moreover, residents living in condominium housings do not have to buy water except at a time of interruptions and provide all sites with drainage & sewer pipes. The above studies are not dealing the issue of water supply challenges and opportunities directly and in detail. But they tried to see water supply in relation with waste water management; condominium housing development for Low and Middle Income Groups, the case of Addis Ababa. Therefore, the issue of water supply in condominium housings is not addressed well in previous studies. Therefore, with the above background, this study seeks to examine the challenges of water supply and possible opportunities in condominium housings of Addis Ababa.

1.3. Objectives of the Research

General objective

The overall objective of this study is to assess the challenges and opportunities of water supply in Addis Ababa condominium housings.

Specific objectives

In view of the above general objective, the study has the following specific objectives:

a) Investigate the major challenges of water supply in the condominium housings of Addis Ababa.

b) Investigate the major opportunities of water supply in the condominium housings of Addis Ababa.
c) Assess and describe how condominium dwellers see the water supply challenges and opportunities compared with their previous residences.

1.4. Research questions

Based on the statement of the problem, the study is attempted to address the following research questions.

a) What are the major challenges of water supply in the condominium housings of Addis Ababa?
b) What are the major opportunities of water supply in the condominium housings of Addis Ababa?
c) How do condominium dwellers see the water supply challenges and opportunities compared with their previous residences?

1.5. Significance of the study

In general, the result of this study may provide useful information to other researchers including students that are concerned with the study of water supply challenges and opportunities on condominium housing. Specifically, it provides:

- Background information for future studies on the area.
- The research findings can initiate other researchers to further study on the challenges of the delivery of similar urban services.
- Policy makers can use the findings of this study for designing a more effective method of water supply.
- Private institutions and NGOs(be it bilateral or multilateral) may use the results of the study as bases for considering improvements and interventions in this program i.e., in assisting with financial and technical support in the area of water supply for condominium housings.

The study will further serve as benchmark data for any further investigation and as an added literature to the existing knowledge.

1.6. Scope and limitations of the study

Every research has limitations and this particular one is no exception. I have faced some limitation during my work on research. Due to time and budget constraints, this study has also restricted the amount of the sample taken and delimited to three sub city condominium housings of Addis Ababa. Commercial and communal condominium houses are not included in this study.

To see it the limitation in detail, firstly, there is an acute lack of references; especially recent and relevant reference books in relation to condominium water supply in different libraries. There has also been no previous research on condominium water supply and so it might be very difficult to do a comparative study or to either improve upon or deal with another side of the previous study. There fore, this thesis may not be exhaustive.

Another limitation is financial difficulties have constrained the researcher to hire a few field assistants to use many interview days and to use a large sample size of the chosen area for the study. This may affect the degree of accuracy and to make accurate generalizations.
Therefore, the sample size of the households taken is 200. Given the current estimate population and household of the study area to be 12,972, the sample size of 200 households for the study has given 1.55 % of the household population and seemed too small to provide a sufficient data to make inductive conclusions and generalisations of the issues of water supply to condominium housings. However it is important to point it out that the study area is similar and have all features of all types of urban settlements. For this academic research, such a small percentage of the household size used is expected to present a reliable picture of the situation.

The other thing is, it is very difficult in Addis Ababa to elicit official information from government departments and agencies and even from individual households. Some people feel uncomfortable to give the correct and absolute information to the researchers for fear of being unknown reason. No matter how open the researcher is, some respondents prefer to either hide their identity or not to give out the real information. Moreover, some respondent households were not at home for the interview; few others were hostile and refused to answer the questions. The other category was those with responding negligently. Most of these people think some researches have political backing. They normally do not want to respond to the questions. These might have influenced the validity and reliability of some of the data generated from sensitive questions in the study. In order to minimize this problem, I used resident committees who are familiar with them to collect data's together with us.

These are all common occurrences observed in some areas of field work in Addis Ababa condominium residents.

1.7. Organization of the study

The study comprises five chapters i.e., it is organized into five chapters. Chapter one is an introduction of the study. This chapter contains background of the study, statement of the problem, research objective, research questions significance of the study and scope and Limitation of the study. The next chapter presents an overview of the literature on condominium water supply and reviews the challenges and opportunities of water supply in condominium housings. In Chapter three the general description of the study area and the methodology section is dealt. Chapter four on the other hand, explains results and discussion. Finally, Chapter five presents conclusions. This section concludes by presenting recommendations.

Chapter Two: Review of Literature

2. 1. Concepts and rational of water supply

Water and housing are the basic necessities for human life. Supply of clean water is absolutely necessary for healthy life and human survival; despite it remains for long period as a critical problem of most of the cities of developing countries including our country.

The problem of water scarcity in urban areas of developing countries is a major concern. When we see the rational of water supply Nelson M. Blake (1956:1) stated how water supply is critical for our survival as "The glass of water which the hungry had always taken for granted with their meals would be unavailable with out water coffee and tea would also disappear from the menu, together with locally manufactured beer and soft drinks. With the water supply knocked out, city dwellers would discover that their choice of foods was shockingly limited. What ever was usually cooked in water-vegetables, soups, stewed meats, and the like-could not be prepared. The baker and the house wife would have no water to make their breadstuffs and pastries". This shows how the availability and supply of water is critical for our survival.

In relation to this, Petrella (2010) mentioned that one can live with out investment fund, Internet and the like; it is not possible to live with out water. A man can survive with out food for months together but without water to satisfy his thirst; his survival beyond 40hours would be a miracle.

Supplying this precious commodity, which is needed for the existence of the population, has to be in the right quantity and quality. Man does not require more than 8 litres of water in liquid form for body needs. Rest of the requirement of water is for bathing, washing, cleaning, scavenging, horticultural, etc. Consumption of water dependent on very many factors such as customs of user community, environment, etc. hence, very great accuracy in estimation of water consumption is not feasible (A.C. Panch dh ari (2000:17).

Moreover, this situation is determined by different factors like the type of house or building (multi-story or single story/conventional houses), topography, source and designs of water supplying networks. For instance, it could be different in the requirement of water for condominium houses from other single story residential houses.

2.2 Condominium housing and Water supply

2.2.1. Condominium housing

Based on UN-HABITAT (2010), Condominium housing is a name given to the form of housing tenure where each resident household owns their individual unit, but equally shares ownership and responsibility for the communal areas and facilities of the building, such as hallways, heating systems, and elevators. There is no individual ownership over plots of land. All of the land on a condominium site is owned by all homeowners. Usually, the external maintenance of the roof and walls are undertaken by a Condominium Association that jointly represents ownership of the whole complex, employing strict management to ensure funding from each homeowner. Figure 1: Condominium housing in Ethiopia, Addis Ababa

Source: Addis Ababa Housing Development Project Office, 2013

According to Gajanayake (2006) and Wedamulla (1997), a condominium is a building or a structure which has two or more stories consisting of parcels, owned and/or used separately by individuals and remaining portion of the property being owned by the owners of individual unit in common.

On the other hand, in Japan, Condominiums have been viewed as a temporary living style until moving into a single-family home. Since the end of the economic bubble period, however, condominiums have come to be regarded as housing units for the urban working class. Japanese

law stipulates that condominiums be managed by management associations organized by and composed of sectional owners (M.Hagiwara , H. Ichimune , M. Nakano ,2009).

In Sri Lanka, based on the International Journal of Sociology and Anthropology (2012), the condominium property means "a property comprising land with building or buildings of more than one unit of residential or non-residential accommodation". In fact, the liberalized economic environment and urbanization process that has prevailed in last four decades has made heavy emphasis on the need of more residential properties in the city of Colombo. Associated with the issue of scarcity of land, the current socio-economic situation has raised the demand for residential condominiums.

According to the International Conference on sustainable Architectural Design and Urban Planning (2007), the main aim of condominium buildings is to provide comfortable living environment for their occupied residents in terms of reasonably room layouts, water supplies, electrical systems.

2.2.2. Condominium housing and Water supply

Cities are growing very rapidly in most parts of the world, especially in countries which are in the stage of economic development. Experts estimate that by the year 2035 two third of the world population will live in cities. Simultaneously to urban growth, the demand of fresh water required for human consumption, for industrial and for agricultural purposes increases with the greater metropolitan areas, and the amount of wastewater released will go up, respectively (Wilderer, 2004).

Condominial water supplies and sewerage systems was first developed in Brazil in the 1990s and have been used in many cities such as Durban, La Paz and Buenos Aires and smaller urban centres like Iquitos, Peru and various small urban centres in Brazil (Rooker, 2001). The best example is Parauapebas in the northern Brazilian state of Pará. Here, the cost savings achieved by the condominial water supply network were considerable: the cost per connection was only USD 45 (1997 USD) vs. USD 167 for a conventional water supply network , despite the basic design criteria being the same in both cases which meant that substantially less 'public' excavation was required (UN-HABITAT, 2006).

However, the basic concept remains valid: the cost of the public distribution network can be substantially reduced if the supply is to condominiums (or co-operatives) rather than to individual households and if the in-condominium pipe work is installed by the condominium

members. Some condominial systems have attracted criticisms for being too brittle, but this is more to do with inadequacies in their construction.

The condominial water supply system has relevance for most small urban centres because it shows how much the costs of a piped water supply network can be brought down. Some of the features of the system will not be replicable in most small urban centres, especially in sub-Saharan Africa and Asia – for instance such high water consumption per household and the provision of connections to each household. But the basic concept remains valid: the cost of the public distribution network can be substantially reduced if the water agency provides the supply to groups of households (including condominiums or cooperatives), rather than to individual households, with these groups managing the connection to each household.

Melo (2005), explained that the condominial approach to the construction of water and sewerage networks developed in Brazil was a response to the challenges posed by expanding services in to peri-urban neighbourhoods. While the condominial model has proved capable of meeting the considerable social and engineering challenges posed by these areas, it is also a generic alternative to the design of water and sewerage systems. Indeed, the Brazilian experience illustrates how the model has been successfully applied to urban neighbourhoods.

The condominial water and sewerage system is based on two key concepts that differentiate it from the conventional model. The first concept effectively redefines the unit to which service is provided. Whereas conventional systems essentially provide services to each housing unit, condominial systems deliver service to each housing block or any group of dwellings that could be termed a neighbourhood unit or "condominium." This is similar to the concept of providing a single connection to an apartment building, except that in this case the condominium is physically horizontal and institutionally informal. As a result of this novel concept, the public network no longer needs to run through every plot of land or to be present in every street, but merely to provide a single connection point to each city block (Rooker, T. M. , 2001; Melo, 2005;UN-HABITAT, 2006).

Therefore, the required length of the network is considerably shorter than that of a conventional system. In addition, an integral condominial design contemplates the decentralization of the drinking water supply or sewerage treatment facilities to avoid the costs associated with transportation of fluids over long distances. The second distinctive concept behind the condominial approach is the development of a much closer relationship between service

providers and users, encouraging the two parties to come to an agreement to facilitate service expansion and adaptation to local needs and constraints (Melo, 2005).

The condominial approach has two defining features. The first is the use of innovative engineering techniques. By routing water and sewerage networks across pavements and yards instead of down the centre of streets, the condominial approach leads to substantial economies in the length, depth and diameter of the pipes. The second is the integration of social and engineering work. By involving communities in the construction and maintenance of the condominial networks, further cost reductions are achieved. Moreover, the interaction with the community during the execution of the works provides opportunities to impart hygiene education and to influence water consumption habits in a variety of ways (Rooker, T. M., 2001, V.Foster, 2001:10).

What is commonly referred to in the literature as the condominial model combines the engineering component with the community participation component. However, it is also possible to apply the engineering approach in isolation of the other interventions, while hygiene education and micro-credit facilities can readily be incorporated into a program involving community participation (V.Foster, 2001:16). Furthermore, the Brazilian experience of condominial systems has always been in the context of public sector service provision (Melo, 2005; V.Foster, 2001; UN-HABITAT, 2006).

In developing its strategies for water supply, sanitation and power, the World Bank is considering the roles condominiums do and might play in these sectors. Condominiums could be involved in collections, thereby alleviating the need for additional staff, meters and other costs of water companies. The employment of condominiums in determining water bills and collecting fees will be especially useful if individual apartment metering is determined to be economically unviable. Condominiums could be employed to conduct a public awareness campaign that includes information on the proper use of water (for which reasons to use and not use it). They also could be relied on to improve the maintenance of building and household water supply infrastructure, and to organize entrepreneurs and small and medium enterprises for this purpose, and perhaps even to maintain infrastructure beyond buildings (World Bank 2001).

Some successful Condominiums already are significantly involved in water supply. Sixty percent of condominiums have contracts with their water supply companies and collect an average of 60 percent of the fees owed for water supply services whereas water company employees experience average collection rates of only 30 percent. As compensation for

collecting fees for water supply services, the water companies allow the condominiums to retain 3 percent of collected fees. Ten percent of condominiums have water meters, which permit fees based on consumption. Since average normative consumption is overestimated, this usually leads to a reduction of 50 percent or more in water fees (Cartwright 2000).

Some other condominiums already maintain water supply infrastructure such as pumps. The involvement of condominiums in maintaining such infrastructure is likely to lead to improved service for residents and improved maintenance of such infrastructure. For this reason, it may be efficient to clearly assign ownership of such infrastructure to condominiums (Cartwright 2000).

2.3. Condominium versus conventional water supply

There are areas of differences and similarities arise between the two systems. In many respects, the two systems are quite similar. For example, the costs of water and sewage treatment, as well as the costs of billing and administration, are essentially the same across the two systems and hence need not be considered in the evaluation. Similarly, the environmental impact of the two systems is very similar since this depends on the level of sewage treatment applied which is not contingent on the nature of the upstream distribution network.

According to V.Foster (2001), key differences do arise in three areas: The first key difference is the cost of water and sewerage distribution networks. Relative to the conventional approach, costs are reduced by applying the condominial engineering design to the distribution network. Further cost reductions are achieved by means of community participation, because the beneficiaries supply their own labour for the construction of the condominial branches. Moreover, when it comes to operating costs of the distribution network, the condominial system reduces costs to the extent that there is community participation in the maintenance of the condominial branches (UN-HABITAT, 2006).

The second area where the two systems differ is the cost of social intermediation. Significant costs of social intermediation only begin to be incurred when community participation is introduced. These increase further if a component of hygiene education (and possibly micro-credit) is introduced. The important point to note is that the variations with the lowest engineering costs also tend to be those with the highest costs of social intermediation (Melo, 2005).

The third key difference between the two systems is the impact on household water consumption. Where hygiene education (and possibly micro-credit facilities) is introduced into the condominial package, it becomes possible to have an impact on the construction of bathrooms and other household water installations, which in turn affects household water consumption. This has both social payoffs in the form of improved hygiene and financial payoffs in the form of higher utility revenues (V.Foster, 2001).

In addition, World Bank (2012) asserted that the condominial system raised interest because this participatory approach has led to substantial reductions in construction costs and improved operation and maintenance.

2.4. Water Requirements and Distribution for Multi story Building

Water has the unfortunate quality of being heavier than air. In fact, it weighs 62.4 pounds per cubic foot. This mass requires a pressure of 0.433 psi to lift water one foot (62.4 lbs/144 in ft). To put it another way, one psi will lift water 2.31 feet (1/0.433). In a single story building with 70 psi in the street, this can be insignificant. In a high-rise building, this factor will drive the design of both the hot and cold water systems (Peter A. Kraut, P.E., 2008:1).

According to A.C. Panch dh ari (2000:16) Water requirement of buildings can be divided in to four broad types as Residential, Industrial, Office building and Building with floating population.

Water supply systems are designed as per standard laid down for various types of buildings. In India, for residential buildings a minimum water supply of 200 litres per head per day is to be assured for a full flushing system. Out of the 200 litres per head per day 45 litres per head per day is meant for flushing requirement and remaining quantity for other domestic purposes. Where buildings are meant for low income group the water supply may be reduced to 135 litres per head per day. There is no other explanation for the reduced requirement but the non availability of adequate number of water points and community type latrines and the payment capacity of low income group being less (Peter A. Kraut, P.E.,2008:1; A.C. Panch dh ari ,2000:17).

In Delhi a survey was carried out in government colonies in the 3 roomed and 4 roomed residential houses which typically represent the middle income group habitat with one WC one bath room, kitchen being provided.

It was observed that under the Indian condition the use of water closets was highest in the morning hours from 5 A.M to 7A.M and at the highest the average use was 4 times an hourly average. Between, 8 to 9 A. M and 5 P.M to 6 P.M there is a drop to two times per hour. Similar is the position in the other systems like bath, sink, and wash basins. Use of fitments however depends on the habits of the people. (A.C. Panch dh ari, 2000:19)

2.5. Design of water supply Networks inside the building

Water when brought in to the building premise from the main or from overhead tank may be, either routed through the underground tank and overhead reservoir through pumping or it may be feed directly to the various outlets of water from mains. Jerry L Work (2011:4) explained that buildings use various pumping schemes. The water supply of a tall building depends on electric pumps and tanks to maintain water pressure. Sometimes the building may need to be divided into zones and each will need its own pump and tank. Tall buildings usually exceed the height that their city's water pressure can handle so they will have to have their own pump and water tanks. One older method made use of water towers placed on the top of the building with fill pumps at the bottom. This method changed to direct pumping systems which used multiple pump packages with constant-speed and constant-pressure controls. Both methods were reliable and many are still in use today, although most are now contained in the walls and basement of the building.

According to A.C. Panch dh ari (2000:20) & Peter A. Kraut, P.E.(2008:1) ,there are two types of water supply networks inside the building. The first one is up feed system of water supply a system in which water is feed directly either from municipal main or through hydro-pneumatic system. The ''up feed ''system of water supply requires high pressure to be maintained in the pipelines all the 24 hour's. The other is System of Down feed water supply; where the water pressure in the municipal main is high enough to reach the terrace level, the mains discharge, water in to the overhead tanks which are normally situated at the highest position. (A.C. Panch dh ari, 2000:21; Peter A. Kraut, P.E.2008:1).

2.6 . Principles of design of water distribution system for g group of building

A distribution system will have many types of consumers, some having heavy demand o water, some not requiring it in large quantities, some areas are predominantly residential and some non-residential, thus requiring water at different times. Correct zoning of areas to be served is a must (Peter A. Kraut, P.E. 2008:2).

The water supply network zoning depends up on: topography, density of population, type of locality, the wastage, leak detection and prevention (A.C. Panch dh ari, 2000: 36). Distribution system for a direct supply to buildings with out an underground tank should be designed so as to have a residential pressure at ferrule point not less than: For construction of buildings of normal 2.8 to 3.5 meter floor height single story -7m of water head, two story -14m of water head and Three story-17m of water head. The distribution system should not have residual pressure exceeding 22m of water head (A.C. Panch dh ari, 2000).

Peter A. Kraut, P.E. (2008) & Jerry L Work (2011) explained that where multi-storeyed construction is to be served then units should have an underground tank where main should discharge very high pressure in main require high intense surveillance for leakage. A.C. Panch dh ari (2000: 37) summarized the distribution system may be:

1. Gravity system (gravity tied from source): It is most reliable and useful in hilly areas where the elevation of source of supply with reference to the area of distribution is much that adequate pressure is obtained in the net work directly.
2. Distributing reservoir system: the water from source is pumped in to an elevated reservoir where from water flows by gravity.
3. Direct pressure system: is where mains pressure is high enough for ensuring supply of water at all floors of building with out any tank system.

The aim of all these systems is to obtain adequate pressure at various points in the distribution system.

2.7.Water supply Challenges and opportunities in condominium housings

Studies suggest that improving the lives of slum dwellers is both socially and economically beneficial in the long run and can go a long way in making cities more productive (Stephanie N. Gilles,2012). This is one goal of condominium housings. Besides, the development and introduction of condominium housings has multiple goals to solve problems of housing and other important infrastructure facilities for the urban poor; like water and sewerage facility, electricity, etc. When we observe the water supply situation of slums and conventional housings with respect to condominium housings, Slums receive less water, even if the number of people living there are greater, because their housing conditions do not allow individual connections in their homes.

On the other hand, K. Sharma (1992) explained that residents living in high rise condominium building they have individual connections in their homes and get a better supply of water in terms of the quantity and the quality of water supplied than slums. People living in high rise condominium buildings generally do not have to buy water except at a time of interruptions, the slum dweller often has to pay on a daily basis for water from their neighbour or from the water seller. Therefore, they end up spending more on water per month per litre than the resident of the high rise condominium housings. The challenge in condominium housings is they need more water than other residential houses.

In most conventional houses and slums water supplies and sanitary conditions are inadequate. According to Bateman et al (1998), when water supplies and sanitary conditions are inadequate, health problems are imminent. However, poor water quality coupled with unsanitary conditions and practices at the household levels, such as absence of sanitary latrines, unsafe waste disposal, over-crowding and unhygienic food preparation, create a dangerous environment with health risks to many households. This is true for urban slums than condominiums.

In high rising condominium housings, the water pressures fluctuate at each level throughout the building and must always be considered in system layouts and when choosing equipment and pipe materials. Providing water to the upper floors is a necessity and also one of the main challenges of a high-rise building project. The engineer must consider building height, available municipal water pressure, and pressure requirements not only at the upper floor but also throughout the building. Booster pump capacity and control, pipe materials, plus many other factors are considered when facing the task of plumbing a tall building. These things are serious challenges in condominium housings water supply (Jerry L Work, 2011:1).

More over, Wubshet (2008) explained that the model of condominium house project provides all sites with drainage and sewer pipes. M. Sharma (2012:1), also states that, most high-rise societies and gated communities generally have backups for water and power, and so compared to independent houses, they are generally better off.

One important thing in condominium housings water supply systems is Community participation brings a number of advantages; among them is a further reduction in connection costs as a result of training local residents to construct and maintain their own condominial branches. Community involvement helps to improve the acceptability of the infrastructure, promoting network connections, and provides an entry point for imparting hygiene education. Moreover, since the labour is provided free of charge, the financial costs of doing the works is

reduced (V.Foster, 2001:7-15). Condominial water and sewerage systems were pioneered in Brazil during the 1980s as a way of bringing piped sanitation services within the economic reach of poor households (Watson, 1995).

Regarding the challenges in condominium housings is concerned, due to the ever increasing population in search of better opportunities and services the drainage and sewer pipes are frequently busting and blocked because they are failing to cope with the increasing pressure. This is true in Addis Ababa (Wubshet, 2008).

Besides,(UN-HABITAT, 2011:42) stated that, the other common grievances in condominium housings is the weakness of the inadequate water pressure on the top floor of the buildings resulting in a noticeably weaker water supply at this level. Furthermore, during times of water shortages, families must collect water in buckets and carry them to their flats as there are no water tanks to generate a secondary water supply in case of such emergency.

Some literatures shows that the challenge in water supply and sanitation as in the provision of adequate clean water and sanitation facilities to urban dwellers are related to capacity of the nations, (i.e. technological know how and institutional), inadequate finance, rapid urbanization and Population growth . In case of condominium it needs large finance, technological know how and institutional effectiveness and efficiency than conventional housings.

UN-HABITAT (2006) pointed out that, there are a number of constraints currently adversely affecting the achievement of the Water and Sanitation MDGs in condominium housings. These include: technical, financial and intuitional challenges.

Lack of technological capacity /Technical constraints: There is currently a general lack of knowledge amongst sector professionals, especially in Africa and Asia, of condominial water supplies and condominial sewerage. Condominial water supplies and sewerage are both very close in theory and design to conventional piped water supplies and conventional sewerage. Many, if not most, national water supply and sewerage design codes do not currently permit the adoption of condominial water supplies and sewerage (UN-HABITAT, 2006).

Sijbesma (1989) explained that technological capacity includes the development and application of new technologies, the technical skills needed to effectively construct, operate and manage a technical solution; the translation of information regarding technologies to promote informed decision-making when implementing a technical solution; the availability and accessibility of spare parts. Innovative technologies are essential to overcome barriers to water and sanitation

service provision. However, technology providers need a better understanding of the local conditions and policies.

Financial challenges: Regarding Financial challenges, too little money is budgeted for water supply and sanitation improvements by national, provincial/state and local governments yet there is plenty of money in the world (Feachem, 2004).

In addition, National financial systems are not geared to support the poor (Basu, 2005). A notable exception is the Graven Bank in Bangladesh and its replicates in other countries. Varley (1995) discusses household credit for water supplies and sanitation. Current water supply and sanitation/sewerage tariffs are often structured in a way that disadvantages the poor.

According to Wallace et al, (2008) water and sanitation has suffered from severe under financing because of inadequate internal financial capacity in the poor countries to achieve water and sanitation goals; poor political decisions for allocation of development aid; an overall reduction over time in development aid; and the limited cost recovery potential in poverty stricken regions.

For example, according to the 2005 Water Supply and Sanitation Millennium Development Goal-Needs Assessment Report by the government of Ethiopia estimates the investment requirements for water at US$297 million per year for the next ten years (2006-2015). Per capita investment for water in urban areas is US$105 while investment for sanitation in urban areas is US$271. Total government allocation and commitment for WSS over the next seven years has been projected at US$12 million (US$6.6 million for urban).

In addition, Prioritisation of spending plays a key role, with many developing countries investing only a small fraction of money into water compared with military spending. Wallace et al (2008) also stated that, to ensure that resources for safe water and sanitation are used effectively at the local level, the local capacities to design, finance and manage improved service delivery must be greatly enhanced.

Institutional challenges: Based on UN-HABITAT (2006), an Institutional challenge explained as Poor governance, combined with an absence of explicitly pro-poor policies, often excludes poor and very poor households from water supply and sanitation improvement projects. The lack of planning at local level often means that one year's budget allocation remains largely untouched until just before the end of the financial year, with the consequence that it is seldom spent

wisely, and often not on pro-poor projects as these are commonly felt to be too 'difficult' to design and implement in a short time period.

Integration and interaction between institutions and different sectors of the population, at decision-making, executive and participative levels is required to plan and execute actions in a coordinated way. This integration is the basis for multi spectral approaches to ensure that planned goals are achieved and actions converge to solve environmental, water and health problems (Wallace et al, 2008).

Wallace et al (2008) summarizes the above challenges as lack of capacity which is a flexible concept and encompasses the public sector, academia; community based organizations and the private sectors, and ranges from the individual to institutions to society as a whole. Capacity can be described in terms of the human, technological, infrastructural, institutional and managerial resources required at all levels from the individual through to national governance. Not only does capacity have to be built within each of these levels, but it has to be institutionalised and local communities need to be empowered to use it effectively.

Population growth and urbanization: Population growth and rapid urbanization will create a severe scarcity of water as well as tremendous impact on the natural environment. According to UNPP (2006), in less developed countries, urban population will grow from 1.9 billion in 2000 to 3.9 billion in 2030, averaging 2.3% per year.

Besides having less or not invested in urban infrastructure, Africa is urbanizing faster than any other region. Between 1990 and 2025, the total urban population is expected to grow from 300 to 700 million; and by 2020, it is expected that over 50% of the population in African countries will reside in urban areas.

According to Cleophace (2007), in order to meet the established millennium development goal of 'halving the unsaved population by 2015'; urban Africa will require 80% increase in the numbers of people served. According to the 1994 Ethiopia population census report showed, the total urban population was 7,323,122 (13.7% of the total population), after ten years (i.e. 2004) the total urban population increased to 17,588,735 (32.89%) and by the year 2015 urban population is going to increase by 22,925,177 (32.26%) Ethiopia Central Statistical Authority (1994, 2004 and 2015 projection). In order to meet the future water demand, cities will need to tap their water supply either from a deep ground or surface sources situating a far distance away from the urban area (Khatri & Vairavamoorthy, 2007). UN-HABITAT (2006) stated that,

increasing global water scarcity not only is the numbers of those requiring better water supplies very large, water itself is becoming scarcer.

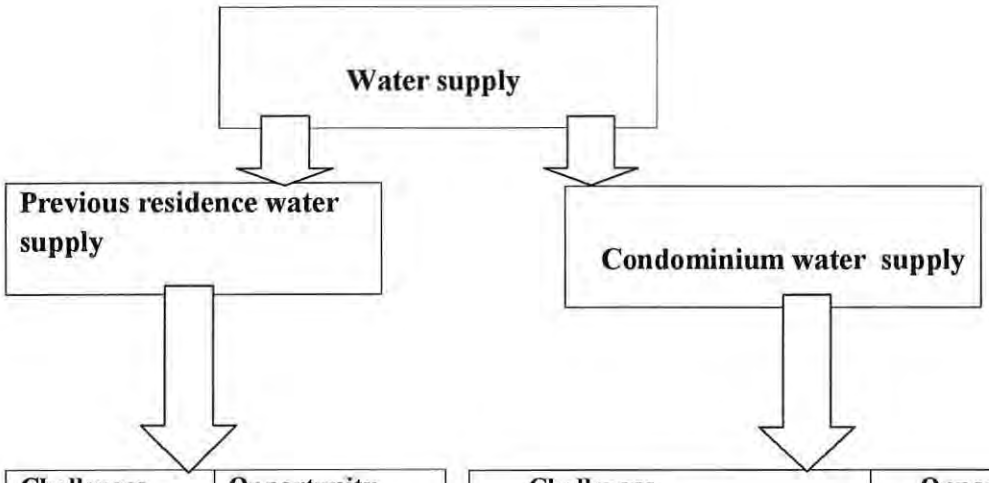
Social issues: Residents participation especially women's involvement is crucially important in water supply issues. It should be born in mind that women are the prime collector of water and are also the first beneficiary of improvement and should, therefore, be involved in any attempt to improve their water supply facilities (churchil, 1987).

Environmental Challenges: Quantity & quality problems of water sources are the most commonly quoted environmental problems of water supply. Regarding quantity problem of water sources, Davis et al (1993) said the continued functionality of water supply schemes depends on a reliable source and system of obtaining water from the source.

2.8. Conceptual frame work

Based on the above stated objectives the following conceptual frame work is constructed. It shows what kind of challenges and opportunities are their both in condominium and previous residential houses. The factors causing water supply problems in condominium housings are multi faceted. On the other hand, condominium water supply is not out of opportunity. Thus, the frame work for the study is constructed by incorporating both the challenges and opportunities in condominium housings and previous residences of conventional/single story houses/. Here, one important thing that must be put in mind is, those points listed as challenge or opportunity in condominium housings are not only a challenge or opportunity of condominium housings. The situation may be the same and those factors listed in condominium housing will also lists and presented in previous/convectional housings water supply. For the purpose of comparison challenges or opportunities observed in condominium vs. residents previous housings are listed in this frame work.

Figure 2: Conceptual frame work



Challenges	Opportunity
For Residents:	**For Residents:**
Irregularity in distribution and Water interruption	No need of additional man power
Pipes aren't private & can not get water as you want	No repetitive water interruption and pressure problem like condominiums
Walking long distance to fetch water, long queue for water	Absence of shift based water distribution in most cases
For the suppler:	**For the suppler:**
Financial problem	-No need of pressure booster.
Institutional problem	No need of high skill and technology as compared with condominium.
Capacity problems	

Challenges	Opportunities
• **For Residents:**	• **For residents**
-Requirement of additional man power	Access to Safe and clean water
-Water Shortage due to interruptions	Private tap with in the unit
-children's risk their lives crossing roads to fetch water	Easily mange by their own
-burden on women's Sanitation problems due to water interruption	No long walking distance to fetch water
-drainage & sewer pipes busting and blockage	
• **For the suppler:**	
Institutional challenge	• **For the suppler:**
Financial ability /budget problem/	-Provides all sites with drainage & sewer pipes
Technical /Technological challenge:	-Provision of water for many residents in one place
Social issues: Residents participation	-Avoid costs associated with transportation of fluids.
women's involvement, Population growth, Rapid urbanization	-Access to Safe and clean water
Environmental issues:	-Conducive for Bill collection
	-Suitable for Water rationing

Source: Own formulation

CHAPTER THREE

3. RESEARCH METHODOLOGY

This chapter presents the geographical profile of the study area and the methodology employed by the researcher in the study. The study areas description section gives the summary picture of the study areas location, major economic activity carried out, and institutions in the area. Further, it presents vegetation, and climate population.

The Research Methodology section of this chapter also presents the sampling techniques, data collection methods, method of data analysis, definition of variables. First it describes sampling designs, sampling methods used and the study population. Following data collection instruments and its sources have been depicted. Following, under the method of data analysis the over all analysis methods used under this study are presented.

3.1. Description of the Study Area

Addis Ababa is the capital city of Ethiopia & diplomatic capital of Africa which is located in the central highlands of Ethiopia that stretches from 1800 to 3200 meters above sea level. The City Administration of Addis Ababa, in geographic terms, is located between 9 02 N, 38 42 E (Ethiopian Government, 2011). G. Tadesse D.Peden P.McCornick (2003) explained that it was founded in 1886 by Menelik II and is located in the heart of the country surrounded by mountains. The city lies at the foot of the 3,000 meters high of Entoto Mountains. In other words, Addis Ababa is located almost in the centre of Ethiopia and it is in an altitude of about 2,400 metres above sea level. It had a built up area of 290 square km in 2004 (UN-Habitat, 2007).

The total area of Addis Ababa covers about 540 Km^2 of which 18.2 Km^2 are rural (G. Tadesse D.Peden P.McCornick, 2003). Its topography is constituted by hills, valleys, rivers and streams. The mean month rainfall based on records of weather station at Bole is minimum 16.8 mm and maximum 278 mm, in the months of January and August respectively (N.M.A., 2011). The average rainy days are 20, 27, 26 and 18 in the months of June, July, August and September, respectively. The mean monthly temperature ranges from 20 0C to 250C during the day time.

Addis Ababa enjoys a mild, temperate climate with a diversified economy, being the main centre of public administration, commerce, manufacturing, finance, real estate and insurance. (Grahns Tryckeri AB, Lund, 2007; UN-Habitat, 2007) .Besides the residents of rural parts of

Addis Ababa, the city dwellers also participate in animal husbandry and cultivation of gardens (Addis Ababa City Council 2004).

According to the official document of the City Administration of Addis Ababa (2010), the total projected population of the City Administration of Addis Ababa for July 2010 was estimated to be 2, 739, 551 persons; disaggregated by sex, 47.65% males and 52.35% females (CSA, 2010). Regarding the life expectancy is concerned UN-Habitat, (2007) it is at 62.8 for males and at 66.5 for females. Even though Addis Ababa is currently experiencing one of the lowest population growths of its history (6.37 in 1976, 3.95 in 1994, 2.92 in 2004), the capital city continues to attract 90.000 to 120.000 new residents every year, mainly due to net immigration (UN-Habitat, 2007).

The capital city, according to the Annual Book of the City Administration of Addis Ababa, was divided into 10 sub-cities and a total of one hundred sixteen woredas/districts for administrative purpose beginning July 2009. The ten sub-cities are: Addis Ketema, Lideta, Cherkos, Yeka, Bole, Arada, Akaki Kaliti, Nefas silk, Kolfe Keranio and Gulele each with an average of 300,000 people. Figure 3. Addis Ababa Sub cities

Source: Addis Ababa city Administration Communication office, 2009.

Regarding the housing condition of Addis Ababa, is by far inadequate in quantity and quality terms to meet the need of the residents. In 1994 the number of housing units (374,742) was 9.5% less than the number of households (414262) which need an equal number of dwellings. (CSA1999).With regard to physical condition, the feature of most of the units is in need of replacement because, 82.3% of the total housing stocks are built up of mud and wood and served for more than 40 years (CSA 1999). As result, the Addis Ababa city administration launched grand low cost condominium housing projects through the Integrated Housing Development Programme (IHDP) in 2006. Currently 80,245 condominium housing units have been constructed and transferred to beneficiaries and 67000 condominium houses are under construction in Addis Ababa city alone (REAL CORP 2010; MWUD, 2008). When we look the description of those sampled sub cities they seem the following.

3.1.1. Kirkos

Kirkos sub-city is one of the ten sub-cities of Addis Ababa, Ethiopia. As shown in Fig. , above Kirkos sub-city is located at the centre of Addis Ababa. National sport and cultural facilities such as Addis Ababa stadium and Meskel square are located in the sub-city. The sub city has 11 Keble's and hosts different governmental, Non Governmental organizations and International Organizations like the African Union Commission and United Nations Economic Commission for Africa (ECA).

Kirkos sub-city covers a surface area of 1,472 ha and has a population size of about 220,991 (Central statistical agency of Ethiopia, 2007). The sub-city is one of the densely populated sub-cities in Addis Ababa with a population density of 150 persons per hectare. Kirkos sub-city is characterised by a combination of modern buildings and old residential settlements. The sub-city is characterized by dense built-up areas. Superficial observations of Kirkos residential areas suggest that it is inhabited by residents with high difference in income.

3.1.2 .Kolfe

Kolfe Keranio sub-city is one of the newly established ten sub-cities of Addis Ababa. It is located in the western part of the city, between 8°57'00"N and 9°05'24"N and between 38°39'36"E and 38°43'12"E. It is 9.6 km from the centre of the city and has an estimated total area of *c.*6400 hectares.

The area was predominantly agricultural land and some areas close to the river gorges were covered with natural vegetation. It is considered as one of the semi-peripheral parts of the city

recognised for its informal business activities. According to the former Administrative Structure of Addis Ababa; the Kolfe area encompasses Keble 9, 10 and 11 from Woreda 24 and Keble 3, 4, 5, 6, 7 and 8 from Woreda 25.

According to the records of the sub-city, the total population of the sub-city was estimated at 261235 in 2011. Geographically, the Kolfe area covers locations stretching from the Dutch Embassy to the General Wingate High School area. The General Wingate area in the north, the Mesalemiya area in the east and the Torr-Hayloch area in the south border Kolfe. Bulecha and Akaki Rivers are the two perennial rivers flowing through the Kolfe area.

Kolfe is home to heterogeneous groups of people who migrated from almost all parts of the country. The four major ethnic groups who live in the area are Amhara, Gurage, Oromo and Gamo i.e., Amhara 39%, Gamo11%, Gurage 25%, Oromo22% and Others3%. The main religious groups are Ethiopian Orthodox Christians, Muslims, Protestants and Catholics i.e., Orthodox Christian 78%, Protestant 8%, Islam 8% and Others6% (RANS, 2005).

Regarding its climate is concerned, like many parts of the country, Kolfe enjoys all the four seasons (Kiremt, Tbi, Bega, Tseday) of the year. Manufacturing, urban agriculture, Trade and marketing are some of the economic activities conducted in this sub city. Moreover, weaving is one of the main handicrafts practiced predominately by the migrant people from the Gamo area in southern Ethiopia. Trade in the area ranges from the smaller street vending to the sale of used clothes

3.1.3. Gulale

Gulele sub city is one of the ten newly organized sub cities in Addis Ababa. The sub city is bordered by Oromia regional state in the North, Kolfe Keranio Sub city in the West, Yeka in the East and Arada and Addis Ketema sub cities in the south. (Addis Ababa, 2009:130). Gulele sub city has a population of 346,026 with household size of 4.2. The population density of the Gulele Sub-city was 9438.9 persons per square kilometres, which ranked it the fourth densely populated section of the City.

The sub city has a total area of 3224.85 hectare (CSA, 2007). In Gulele Sub-city there are currently a total of 10 Woredas. Topographically the sub city is mountainous. This mountain is covered with forest and it is part of the city"s green area. The forest has both economic and environmental usage. Gulele sub city has cold climatic condition than the other parts of the city. There are number of religious places. In terms of health, the sub city has two federal hospitals, one higher clinic, three health centre, six health posts and about 28 private clinics. Concerning education, the sub city education bureau has managed to stop shift system. Student- class room

ratio reached to 1:57 in elementary schools and 1:61 in secondary schools, student –book ratio has reached 2:3. (ACB, 2009:25).

The sub city is composed of self-employed household heads engaged in weaving activities; tailoring, collecting and selling firewood, trading ready made cloths; petty trading, and daily laborers are major actors in the study area, followed by government enterprises, private institutions and other members of the enterprises, and the unemployed household heads. According to the 2008 report, the sub city faces multidimensional social and economic problems. It includes, unemployment, homelessness, HIV/AIDS, street children, prostitution, and other social evils are flourishing at an alarming rate.

3.2. Research Methodology

3.2.1. Study design

The research were make use of detailed analysis of the challenges and opportunities of water supply of condominium housing of Addis Ababa using primary and secondary data sources such as questionnaires interviews, focus group discussions, observations and document analysis. The study was used concurrent data collection strategies in which both quantitative and qualitative data was collected at the same time. The use of quantitative approach has the potential of covering many subjects to enable generalization and address various issues. It also helps to analyse trends of different variables. The qualitative on the other hand is used to corroborate the data gathered using questionnaire and enable to get in-depth information about the opinions and perspectives of subjects articulated in their own words. In addition, both deductive and inductive approaches were employed to assess the levels of water supply in condominium housings of Addis Ababa.

3.2.2. Data sources

The study plans and collect all the necessary data required for the study from primary and secondary sources by using multiple tools of data collection. Therefore, Primary sources of data was collected through interview with selected sample households of condominium dwellers and officials and experts from Addis Ababa water and sewerage authority key informant interview, focus group discussion of committee members of condominium housings and through personal observation. Secondary sources of data were data that help to review the overall water supply challenges in the study area. Relevant documents concerning issues of quantity, quality,

distribution problems and its consequences in the life of urban specially and condominium dwellers are the major sources of secondary data.

3.2.3. Data collection Instruments & Methods

To be able to achieve the stated objectives of this study, a number of relevant research instruments and methods, which included primary and secondary data collection, were employed. The primary data collection methods include: questionnaire, and informant interview, and document reviews i.e. multiple data gathering instruments were used to collect data for the study. In short

3.2.3.1. Primary Data

Household survey: To generate information at household level, semi–structured and structured questionnaires were used. Prior to conducting the survey, pre-test of the survey schedule was under taken and accordingly remedial action was made and finalized. Then the survey conducted to the selected respondents in the study condominium site

House holds in the selected condominium housings of Addis Ababa that benefit from the water supply program is vital to identify the problems in detail as they have all the knowledge of their benefit. Semi structured questionnaire interview was selected due to its flexibility which enables the researcher to ask respondents' opinion on current levels of water supply service delivery like how they access to clean drinking water, how much they pay, at what duration they can get water and other related questions. It also gives opportunities' to the respondents' to express their feelings, ideas and opinions more about the problems at hand.

Focus group discussions (FGD): through this technique a group consisting of 9 committee members of condominium housings were purposively sampled and were freely discussed on the water supply challenges and possible opportunities by comparing their previous residences and their new condominium housings and depth information was obtained. To elicit the required information, open ended and general questions were used..

Key Informant interview (From the supplier's side): A key informant interview was important in getting information pertinent to the institutional aspects of water supply in condominium housings. Hence, a group consisting of 10 members; 1 branch manager from each branch office of AAWSA, 2 officials from the head office of the AAWSA were selected and carried out the Interviews about the water supply coverage, the balance between demand and supply of water in condominium housings of Addis Ababa, major challenge faced in the provision of these services and the like. These key informants were purposively selected

believing that they have deep and relevant information about the issues from their official responsibilities and continue involvement in the issues.

Personal Observation: This were carried out in order to obtain information how residents of condominium housings collect water when there is no water in the building and some other important situation related to water supply. Therefore, I carried out documentation of the area's water collection and storing methods with photographs. I made various visits to the site to make preliminary assessments. This initial observation was followed by a more focused survey to identify the main characteristics of the area.

3.2.3.2. Secondary data /Documentary Review/

In addition to primary data, secondary data also collected from different sources. Accordingly data was collected mainly from the secondary data sources which include both published and unpublished materials such as books, reports, and statistical abstracts, research journals, and policy and strategy documents was consulted to supplement the primary data. In other words, Secondary data's collected from different publications, studies and reports of Addis Ababa water and sewerage authority, Census and survey reports, Addis Ababa Information communication Burro reports, journals as well as other documents.

3.2.4. Sampling and sampling procedure

This study basically focuses on investigating the water supply challenges in condominium housings of Addis Ababa. To conduct it, it needs to collect primary data from each beneficiary of the service. But due to some constraints like finance and time, the researcher was focus on selected households. Therefore, sampling technique is used to select the target population.

The sample size for this study was determined based on the assumption that there is no adequate information about the magnitude of water supply challenges in the study area. It is desirable to have a sample which is representative of the total house holds of housings as much as possible. Thus, the sample size of the house hold for this study was 200 house holds.

The sample respondents were selected from three sub cities using the following way: In Addis Ababa, there are ten sub cities. Theses are Arada, Addis Ketma, Ledeta Kolfie Keranio,Yeka, Nifas Silk, Kirkos, Akak, Gulelie, and Bolie.

Out of these ten sub cities, three were selected using simple random sampling technique. The selected sub cites using these approach are Kirkos, Gulale and Kolfe keranio. Each sub city has fifteen, nine, and nine sites respectively; their total equals to 33 sites. Then, from each sub city only one condominium site is selected based on the same procedure. Therefore, Dandi Boru site from Kirkos sub city, Mikililand site from Kolfe Keranio and Menen site from Gulele Sub city are selected randomly. Then, from these condominium sites housing blocks were selected based on their number, i.e., there are 123 housing blocks in Mikililand. And housing blocks from this site are selected randomly. But in Menen and Dandi Boru condominium sites there are 2 and 3 housing blocks respectively. There fore, all blocks are taken purposively from these two sites.

As stated above, the Sample size is fixed to 200 as it is impossible to cover all the sites and blocks. After the sites, blocks and the sample size were identified the next step is to take sample from the study population. Thus, samples were taken proportional to the size of the residential houses of each sub city and applying this number directly to each condominium sites. Then, the respective households were selected randomly from each block but first I have tried to limit the number of housing unit selected purposively in each floor of the building to address equal distribution of housing units.

Table 1: Sample selection procedure

Sub city	No of Sites in each sub city	No of Blocks in each sub city	No of residential houses in each sub city	population Size by proportion	Sample sites	No of blocks in each site	No of housing units in each site	Selected sample
Kirkos	15	137	3851	29.6	Dandi Boru	3	90	59
Kolfe	9	237	7831	60	Mikililand	123	4287	121
Gulele	9	48	1290	9.9	Menen 2	2	50	20
Total	33	422	12972	100				200

Source: Housing Development Project office report of the department of research planning and budget, houses transfer 2012.

Table: 2. Condominium sites, number of blocks & residential houses in sample sub cities

Sub city	The Name of the Site	Number of Blocks	Number of residential houses
Kirkos	Temenja Yazee	3	112
	Meskel Flower	4	136
	Bulgaria Mazoriya	3	104
	Amalgameted	7	202
	Lebie Fana	4	108
	Legehar	7	207
	Kirkos12	4	108
	Kirkos4	3	78
	Kirkos 34	5	133
	Mesfine Meda	7	260
	Dandi Boru	3	90
	01/19	2	70
	Kirkos 1 (GTZ)	3	42
	Kirkos 2 (GTZ)	4	48
	Gotera	78	2153
Total	**15**	**137**	**3851**
Kolfe	Keranyo 2	13	450
	Keranyo 3	5	176
	Reppi 1	34	1173
	Reppi 2	9	332
	Mikililand	123	4287
	China Embassy	3	92
	Milifoni (GTZ)	8	234
	Keraniyo 1(GTZ)	27	706
	Asko (GTZ)	15	381
Total	**9**	**237**	**7831**
Gulele	Office of Kebele 12	5	200
	Israel Embassy	4	160
	Chelot Ersha sebel	3	120
	Menen 1	3	120
	Menen 2	2	50
	Tsion hotel 09/15	6	244
	Kebel08	3	120
	Gulelie 1 (GTZ)	13	166
	Gulelie 2 (GTZ)	9	110
Total	**9**	**48**	**1290**

Source: Housing Development Project office report of the department of research planning and budget, houses transfer 2012.

Selection of key informants

As stated earlier, key informants were selected from Addis Ababa water and sewerage authority and its branch offices using non probabilistic purposive sampling technique.

Table: 3. Sample of key informants

No	Source of Informant	No. of selected key Informants	Methods of selection
1	Heads or Officials or experts from Addis Ababa water and sewerage authority.	2	Purposive i.e., using non probability purposive sampling technique.
2	Heads or experts from Branches of Addis Ababa water and sewerage authority	8	Purposive i.e., using non probability purposive sampling technique.
	Total	**10**	

3.2.5. Development of questionnaire

In the development of the questionnaire a number of discussions were held with my advisor. Initially references were made to questionnaires adopted by other studies such as those studies focusing on water supply even though they were different from condominium housing water supply. In the process of the development of the questionnaire areas of focus were identified. The content of the questionnaire is such that it can assist in finding answers to the research question and meet the objectives of the research. These include the water supply problems of the housing unit, the nature of the water supply problem in the previous housing unit, the opinion that residents themselves, the opportunities of the water supply situations in previous and current condominium housing unit.

3.2.6. Method of data analysis

Analysing the data is a crucial part of the study. In order to meet the specific and general objective of the study multiple methods were used ranging from quantitative to qualitative methods for the reason that factors that determine the household's water supply. The data analysis employed analytical techniques or procedures. Qualitative and quantitative data's gathered from primary and secondary sources were analysed using different statistical techniques. The data collected through house hold survey questioners was tallied and

analysed using the statistical package for social science (SPSS) version 20 computer software packages which is a highly useful tool in analysing data. It means for quantitative data, descriptive statistical method of analysis, such as frequencies and percentage were used and the findings were described and presented in tables and graphs. A thematic or narrative method was also employed to analyse the qualitative data which was collected through structured interviews, FGD and physical observation in a way to better complement and describe variables in the existing conditions of impacts of condominium water supply and on the livelihood of the residents.

Chapter Four: Data Analysis & Discussion

4. 1. Survey Responses of the households

A total of 200 survey questionnaires were distributed to condominium housing residents, in three sites of kirkos, Gulale and Kolfe keranio sub cites. Two data collectors under the researcher close and serious supervision administered the data collection. In the survey, 200 housing units were covered in three sample sites (Dandy Boru of kirkos sub city, Mennen of Gulale sub city and Mikililand of Kolfe keranio sub city).

From these all filled on questioners (100 percent) were returned. Table 4 shows the number of respondents in each sub city and condominium sites.

Table 4: Number of sample respondents by site

Sub city	Condominiums Site	Frequency	Percent (%)
Kolfe	Mikililand	120	60.0
Gulale	Mennen	20	10.0
kirkos	Dandy Boru	60	30.0
	Total	200	100.0

Source: Field survey, 2013

As you see in the table above 60 percent of respondents of Dandy Boru site of kirkos and 20 percent of Mennen site of Gulale sub city are returned the entire instrument. On the other hand, from Mikililand site of Kolfe keranio sub city 120 percent filled on questionnaires are returned.

4.2. Origin /previous address/ of respondents

Regarding residents previous address is concerned, respondents of each condominium sites were living in different sub cities, Woredas and Keble's. They were also living in different types of housing features. Table 5 demonstrates that in Mikililand most residents came from Gulale (33) followed by Kolfe (31). In Dandy Boru condominium site the origin of residents is 21 households from Ledeta, 10 households from Kirkos and 8 households from Bole, whereas, in Mennen condominium site the residents origin is from Kolfe and Gulale 5 households in each sub city and from Yeka 4 households.

Table 5: Origin /previous address/ of respondents

Previous sub city	Respondents condominium site			Total
	Mikililand	Dandy Boru	Mennen	
Bole	3	8	1	12
Yeka	8	2	4	14
Kirkos	3	10	0	13
Ledeta	12	21	3	36
Kolfe	31	3	5	39
Arada	16	1	1	18
Nefassilklafto	2	2	0	4
Akaki kaliti	0	6	0	6
Gulale	33	7	5	45
Addis Ketema	12	0	1	13
Total	120	60	20	200

Source: Field Survey, 2013

Besides, regarding for how long the household reside in their previous houses or address, most of the households i.e. 33% responded that they lived above15 years. In addition, 59(29.5%) of the respondents have lived in the range of 6 to 10 years, 43(21.5%) of them lived less than and equal to 5 years. The remaining 16 % of respondents have lived ranging 11to 15 years.

4.3. Water supply conditions of Beneficiaries

In this part of the study the summery of respondent's responses on water supply and related questions, that is, their previous housing and current condominium housing water supply conditions are presented. The situation of water supply especially the water supply challenges and opportunities of condominium housings and the previous housings are analysed independently. In addition, those possible interventions should also present. Further more, the satisfaction level of the respondents in condominium housing water supply are also analysed.

4.3.1. Previous residence water supply situations

The previous water supply situation is very important to see and understand the major challenges and opportunities of water supply in their previous stay and comparatively with their current condominium housings.

1. Previous residence water supply sources

The survey result in the study area shows that majority of the respondents are using water from piped to compound followed by water from piped in to dwelling unit. As table 6 clearly demonstrate, the major source of water for 125(62.4%) of the respondent households in the previous residence are from piped water in to dwelling unit and 44(22.3 %) of the respondent households have got water from the source of piped water in to dwelling unit. The remaining 31(15.3 %) of the respondents got water from public stand pipe.

Table 6: Previous residences water supply sources

Water source	Frequency	Percent
Piped in to dwelling unit	44	22.3
Piped to compound	125	62.4
Public stand pipe	31	15.3
Total	200	100.0

Source: Field Survey, 2013

Further more, respondents were asked whether they were used the same source of water through out the year or not. The survey data showed that 84.4 percent of them used the same source of water whereas 15.6 percent of the households not used the same source through out the year. These respondents used alternative sources like purchase from other neighbouring Keble, springs, wells and bono water when water interruption occurred.

As can be observed from table 7 the highest proportion of households 17 (60.7 percent) used water purchased from other Keble, 7(25 percent) of the respondents use bono water, the remaining 10.7 percent and 3.6 percent of the respondents used water from spring and wells respectively.

Table 7: Other sources of water in previous residence

Other source	Frequency	Percent
Purchase from other Keble	17	60.7
Spring	3	10.7
Wells	1	3.6
Public stand pipe/Bono/	7	25.0
Total	28	100.0

Source: Field Survey, 2013

2. Previous Water Need & Consumption

In addition to the availability of water in different sources, respondents are also asked about their previous water need and consumption. From the survey result we observed that, most respondents used their previous water for drinking, cooking, bathing and washing whereas some respondents were using for toilet and in some cases for gardening purposes. Therefore, table 8 below showed that, 200(21.7%) of the respondents were using their water for drinking and the same percent of respondents were also using for cooking. On the other hand, 188(20.4%) of the respondents were using their water for bathing, 132(14.3%) of the respondents were using for toilet and 11(1.2%) respondents were using for gardening purposes.

Table: 8: Previous residences water need of households

Purpose /Need/	Frequency	Percent
Drinking	200	21.7
Cooking	199	21.6
Bathing	188	20.4
Toilet	132	14.3
Washing	190	20.7
Other/for gardening/	11	1.2
Total	920	100.0

Source: Field Survey, 2013

Based on the focus group discussion made with condominium residents committee members, they have explained that, in most cases, in their previous residence they use their water for different activities such as drinking, cooking, washing in effective manner. Due to shortage of water and the nature of housings, water for the purpose of toilet flashing is not that much large and in most cases households do not use water for toilet purposes.

Regarding previous water consumption of households, table 9 clearly demonstrate that, 61(30.5 %) of respondents the amount of their previous average daily water consumption was between 81 and above litres of water per day. In addition, 51(25.5%) and 40(20.0%) of respondents previous average daily water consumption were between 21 to 40 litres and 41-

60 litres of water respectively. The remaining 16(8.0%) of respondents their previous average daily water consumption is between 61-80 litres of water. See table 9 below.

Table 9: Previous residence water consumption of households

Previous water consumption	Frequency	Percent
Less than & equal to 20 litres	32	16.0
21-40 litres	51	25.5
41-60 litres	40	20.0
61-80 litres	16	8.0
81 and above litres	61	30.5
Total	200	100.0

Source: Field Survey, 2013

When we see the water consumption in relation to family size of respondents, family size and water consumption is directly proportional and those who had large number of family size need large amount of water for their different family needs and is crucial to lead their daily way of life.

Therefore, regarding family size of the respondents and water consumption, the survey result showed that from the total household respondents, the majority 134(67.7 percent) of them had 3 to 5 household members, 37(18.7 Percent) of the respondents had family size of 6 to 8 and 25(12.6 percent) of respondent household had less than three household members. As you see in table 10 below, 42 respondent house holds who had a family size of 3 to 5 consumed 81 and above litres of water whereas only one respondent house hold who had a family size of less than three consumes this stated amount of water.

In addition 15 respondent house holds who had a family size of 6 to 8 consume 81 and above litres of water whereas only one respondent house hold who had a family size of less than three consumed this stated litres amount of water. We can see the situation in table 10 below.

Table 10: Households' family size and average daily water consumption

Average daily water consumption in litres	Household size				Total
	Less than three	Three to five	Six to eight	Nine and above	
Less than equal to 20 litres	2	20	9	0	31
21-40 litres	7	36	8	0	51
41-60 litres	10	25	5	0	40
61-80 litres	5	11	0	0	16
81 and above litres	1	42	15	2	60
Total	25	134	37	2	198

Source: Field Survey, 2013

Moreover, when we see the water consumption in relation to marital status of interviewed sample households it seems the following. The survey result showed, out of 200 heads of households in sample population, 165 (82.5 percent) are married, 22 (11.0percent) never got married leaving; the rest 6 (3.0percent) and 7 (3.5percent) are divorced and widow respectively. This implies that majority of the respondents are a couple or living a married life.

As table 11 showed, about 47 married households from the total respondent households and 6 single(not married) house holds their average daily water consumption were 81 and above litres of water. This showed married couple consumed and need more water as compared with those of no married. We can see the whole scenario from the following table.

Table 11: Marital status and average daily water consumption

Average daily water consumption in litres	Marital status of the household				Total
	Married	Single	Divorced	Widowed	
Less than equal to 20 litres	25	4	0	3	32
21-40 litres	47	4	0	0	51
41-60 litres	33	5	2	0	40
61-80 litres	13	3	0	0	16
81 and above litres	47	6	4	4	61
Total	165	22	6	7	200

Source: Field Survey, 2013

When we see toilet and bathing facility in previous home of respondent households and its water consumption, it seemed the following. In this regard, respondents were asked whether they had a toilet facility or not in their previous residence and its water consumption. Based on that the survey data showed that, about 188(94.0%) of the total respondents had toilet in previous home. On the other hand, 12(6%) of the total household respondents, they did not have toilet facility in their previous home.

The survey data further showed that, the type's of toilet facility does the previous housing unit has. 79(41.6 percent) of the household had hole in ground type of toilet and 69(36.3 percent) of the respondents had toilet with flash private.

Table 12: Types of toilet facility in previous residence of households

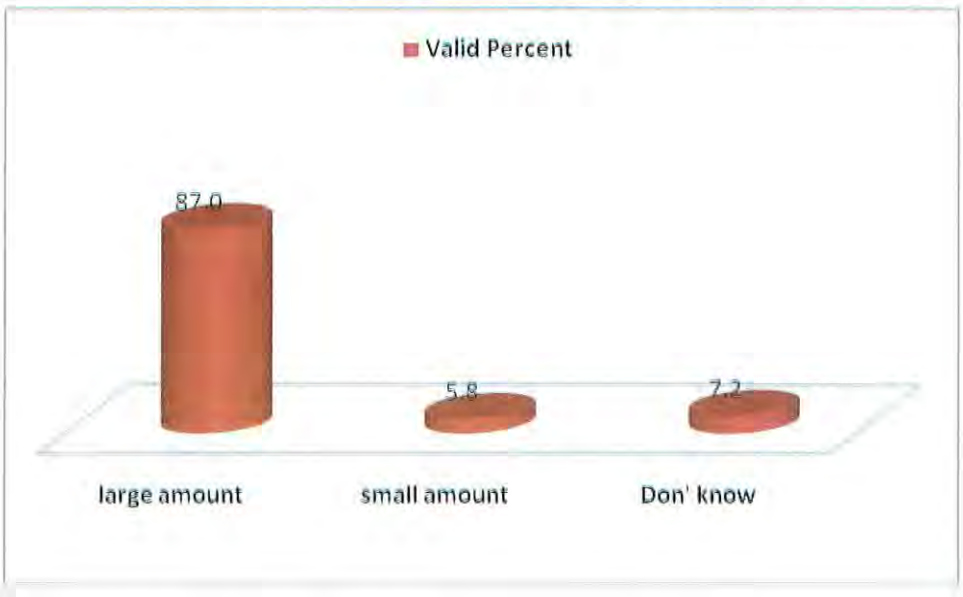
Toilet types	Frequency	Percentage
Toilet with flash private	69	36.3
Toilet with flash shared	6	3.2
Pit latrine private	24	12.6
Pit latrine sheared	12	6.3
Hole in ground	79	41.6
Total	190	100.0

Source: Field Survey, 2013

According to table 12 above, 24(12.6 %) respondents and 12(6.3%) of the respondents reported that they had pit latrine private and sheared respectively. Others 6(3.2%) replied that they had toilet with flash sheared.

Regarding the water consumption of those toilets which were flash type, respondents said they consumed large amount of water. As Figure 4 shows below, 87.0% of the total respondents replied that it consumed large amount, whereas 5.8% of the respondents reported that it consumed small amount.

Fig 4: Flash toilet water consumption in previous Residence



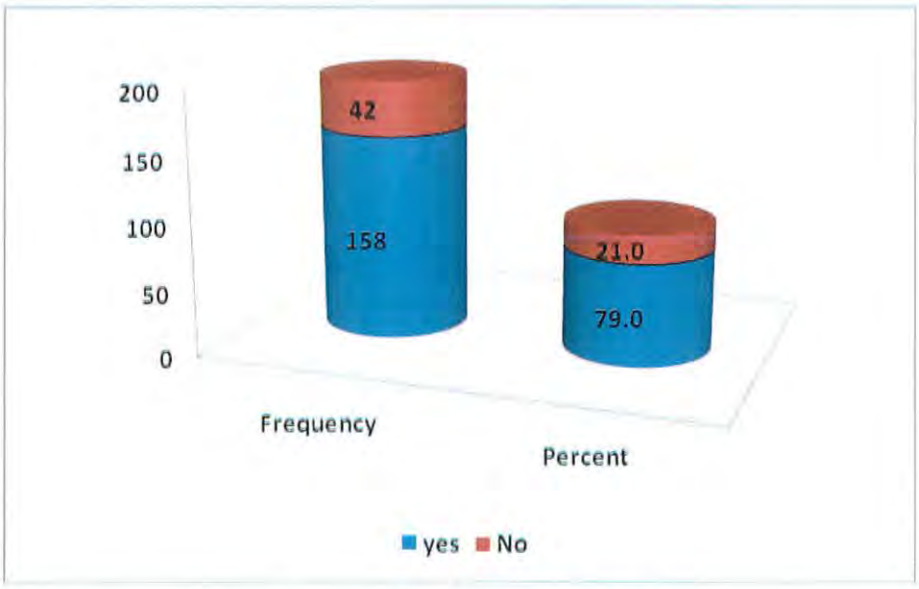
Source: Field Survey, 2013

Besides, regarding bath facility, the survey showed that most of them, 110(55 percent) of the respondents had separate bathing facility in their previous home whereas 90(45%) of them do not have a separate bathing facility. Those households who didn't have a toilet facility, 50% of them take in public toilet and 21% of them used their neighbour's residence toilets.

1. Quality of Respondents Previous Residence water & sanitation facility

Regarding the quality of previous residence water and sanitation, as you can see from the figure 5 below, 158(79.0%) of the respondents previous housing units water and sanitation facility were good whereas 42(21.0%) of the respondents previous housing units water and sanitation facility were not good. You can see the situation from the figure below.

Fig 5: Quality of Respondents Previous Residence water & sanitation facility



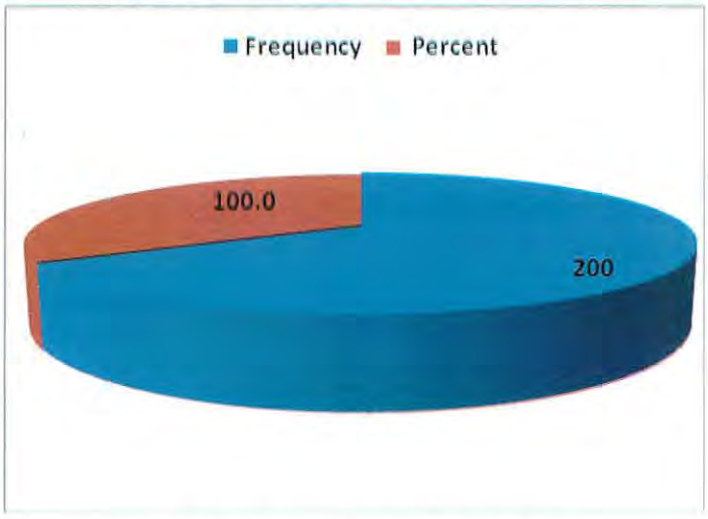
Source: Field Survey, 2013

4.3.2. Condominium housing units Water supply Conditions

1. Condominium housing units water supply sources & flow of water tap per week

The availability of water in condominium housing units depends upon the regularity and the adequacy of supply. The survey results show that 100% of the households in the study areas are connected to the water supply system. No housing unit is with out pipes connected to their homes. This is shown in the following figure.

Figure 6: Pipes connected to Condominium housing units



Source: Field Survey 2013

Frequency of flow of water has been a major concern for the households of condominiums. Regarding the frequency of tap flow, the survey results indicated that for most of the

households, water flows mainly on 1 -2 days in a week or maximum of 2 days in a week. As indicated in the table 13, 107(51.2%) of those interviewed respondent households mentioned 1 to 2 days as the main days that water flows from the taps.

Unfortunately, for any of those 2 days, taps may flow for some few hours and stop, leaving people in frustration. Households therefore have to use those 2 particular days in the week to fetch water, which they store for use for the whole week. 46(22.0%) of those interviewed respondent households also reported that water flows from the taps 3 to 4 days in a week.

In addition, 26(12.4%) and 22(10.5%) of respondent households reported that their water tap flows all days of the week and 5-6 days in a week respectively. Further more, 5(2.4%) and 3(1.4%) of respondent households mentioned that their water tap flows 1 day within 4 days and 1 day in a week respectively.

Table 13: Flow of water tap per week

Flow of Water per Week	Frequency	percentage
All days of the week	26	12.4
1-2 days in a week	107	51.2
3-4 days in a week	46	22.0
5-6days in a week	22	10.5
1 day within 4 days	5	2.4
1 day in a week	3	1.4
Total	209	100.0

Source: Field Survey, 2013

This is the general scenario of all the study areas. But, when we see the situation in relation to each respondent condominium sites, the scenario is changed. As table 14 displays below, in Mikililand site about 102 respondent households reported that their tap flows 1-2 days in a week, No respondent house hold reported that, water flows all days of the week and 5-6 days in a week, where as in Dandy Boru site 24 and 22 respondent households water tap flows 3-4 days in a week and all days of the week respectively. No respondent households also reported their water tap flows 1-2 days in a week, 1 day within 4 days and 1 day in a week in Dandy Boru condominium site. In Mennen, most respondent households water tap flows 5-6 days in a week and 3-4 days in a week.

Table 14: Flow of water tap per week in each condominium site

Flow of Water per Week	Respondents condominium site			Total
	Mikililand	Dandy Boru	Mennen	
All days of the week	0	22	4	26
1-2 days in a week	102	0	2	104
3-4 days in a week	10	24	6	40
5-6days in a week	0	14	8	22
1 day within 4 days	5	0	0	5
1 day in a week	3	0	0	3
Total	120	60	20	200

Source: Field Survey, 2013

2. Condominium housing Residents water Need & Consumption

When we see condominium housing residents water need, the survey showed that, most respondents used their previous water for drinking, cooking, bathing , washing, for toilet flashing, car washing and. Some respondents also used the water for corridors flowers.Table 15 below showed that, 200(20%) of the respondents were using their water for drinking and199 (19.9%) of respondents were also using for cooking. On the other hand, 198(19.8%) of the respondents were using their water for bathing and the same percent of respondents used for toilet flashing, 197(19.7%) of the respondents were using for car washing.

Table 15: Condominium residences water need

Purpose /Need/	**Frequency**	**Percent**
Drinking	200	20.0
Cooking	199	19.9
Bathing	198	19.8
Toilet flashing	198	19.8
Car washing	197	19.7
Corridors flower	6	.6
Total	998	100.0

Source: Field Survey, 2013

Respondents in the study areas were also asked that, on the average, in what type of container and how many litres of water do they need for their household per day as compared with their previous residence. Therefore, as table 16 shows, 25.5% of the households interviewed use more than 100 litres i.e., 5jericas/baldi (20 litres size) of water per day for their drinking, bathing, washing, cooking, toilet flash and for corridors flower. This is below the standard of water supplied for a household of Addis Ababa i.e., 110 litre per day. 22.5% use 80 litres i.e., 4 jericas/ baldi (20 litres size) of water per day, 17.5 % use 60 litres i.e., 3 jericas/ baldi (20 litres size)) per day whilst 14.5% say they use 40 litres per day. More over, 8% say 120 litres, 6% say 20 and more than 120 litres of water per day.

Table16: Condominium Households Average water consumption

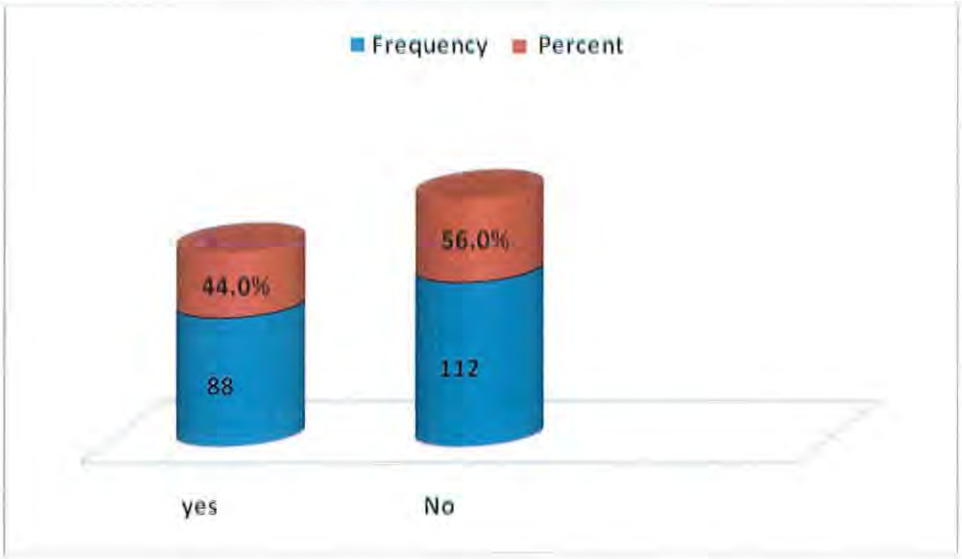
Households Average water consumption	Frequency	Percent
1jerica/Baldi i.e. 20 litres	12	9.0
2jerica/baldi i.e,40 litres	29	14.5
3jerica/baldi i.e,60 litres	35	17.5
4jerica/baldi i.e,80 litre	45	22.5
5jerica/baldi i.e,100 litres	51	25.5
6jerica/baldi i.e,120 litres	16	11.0
Total		100.0

Source: Field Survey, 2013

In the survey of 200 households, 134(67.7%) of the respondents have a family size of 3 to 5; 37(18.7%) have 6 to 8, 2(1.0%) of the households have 9 and above and 12.5 % of them have family size of 3 and less than 3. This means the majority of the households interviewed (67.7%) have a household sizes falling between3 to 5.

The households were asked about the sufficiency of the water they use per day to meet their household requirements and the responses were recorded in Figure 7 below. As you see in the figure, 88(44%) of them reported a positive response even though it is below the standard amount of Addis Ababa's single residence, whilst 112(56 %) of them reported in the negatively.

Figure 7: Water sufficiency to condominium household respondents



Source: Field Survey, 2013

Based on the interview made with Addis Ababa water and sewerage Authority officials, the major constraints of distribution system identified are low density of pipelines network, absence of reservoirs and inadequate pressure in the pipe. As a result, water consumption and sufficiency is affected in these areas by socio-economic factors such as population growth, marital status, household income and size that affected their water consumption.

For instance, the water consumption of respondents of condominium housing units in relation to family size shows that, those who had large number of family size need large amount of water for their different family needs.

As you see in table 17 below, 38 respondent house holds who had a family size of 3 to 5 consumed 100 and above litres of water whereas only one respondent house hold who had a family size of less than three consumes this 100 litres of water. In addition, 9 respondent house holds who had a family size of 3 to 5 consume above 120 litres of water whereas only one respondent house hold who had a family size of less than three consumed these litres of water. We can see the situation in the table below.

Table 17: Households' family size of the respondents' and average daily water consumption in condominium housing units

Average daily water consumption in litres	Household size				Total
	Less than three	Three to five	six to eight	Nine & above	
1jerica/Baldi i.e. 20 litres	4	7	2	0	12
2jerica/baldi i.e,40 litres	2	20	6	0	28
3jerica/baldi i.e,60 litres	5	18	12	0	35
4jerica/baldi i.e,80 litres	12	28	5	0	45
5jerica/baldi i.e,100 litres	1	38	11	0	50
6jerica/baldi i.e,120 litres	0	14	3	0	16
Other(less than 1& above 6jerican)	1	9	0	2	12
Total	25	134	39	2	200

Source: Field Survey, 2013

Moreover, when we see the water consumption in relation to marital status of interviewed sample households it seems the following. As table 18 showed, about nine married households from the total respondent households and one single (not married) house hold their water consumption were above 120 litres of water. This showed married couple consumed and need more water as compared with those of no married. We can see the whole scenario from the following table.

Table 18: Marital status and average daily water consumption in condominium housing units-cross tabulation

Average daily water consumption in litres	Marital status of the household				Total
	married	single	Divorced	Widowed	
1jerica/Baldi i.e. 20 litres	4	7	1	0	12
2jerica/baldi i.e,40 litres	2	20	6	0	28
3jerica/baldi i.e,60 litres	5	18	12	0	35
4jerica/baldi i.e,80 litres	12	28	5	0	45
5jerica/baldi i.e,100 litres	1	38	11	0	50
6jerica/baldi i.e,120 litres	0	14	2	0	16
‹1 &›6 jerican/ Baldi	1	9	0	2	12
Total	25	134	37	2	198

Source: Field Survey, 2013

More over, household were also asked about whether they use the same source of water throughout the year the one provided by the municipality to their condominium unit. Then the survey showed, 157 (78.5%) of the respondent households responded positive i.e., they have got from one source provided by the municipality and 43(21.5%) of them responded negatively, they use other additional sources; like packed water, spring water, water from wells and Rivers water.

Table 19: Other source water in condominium housing residents

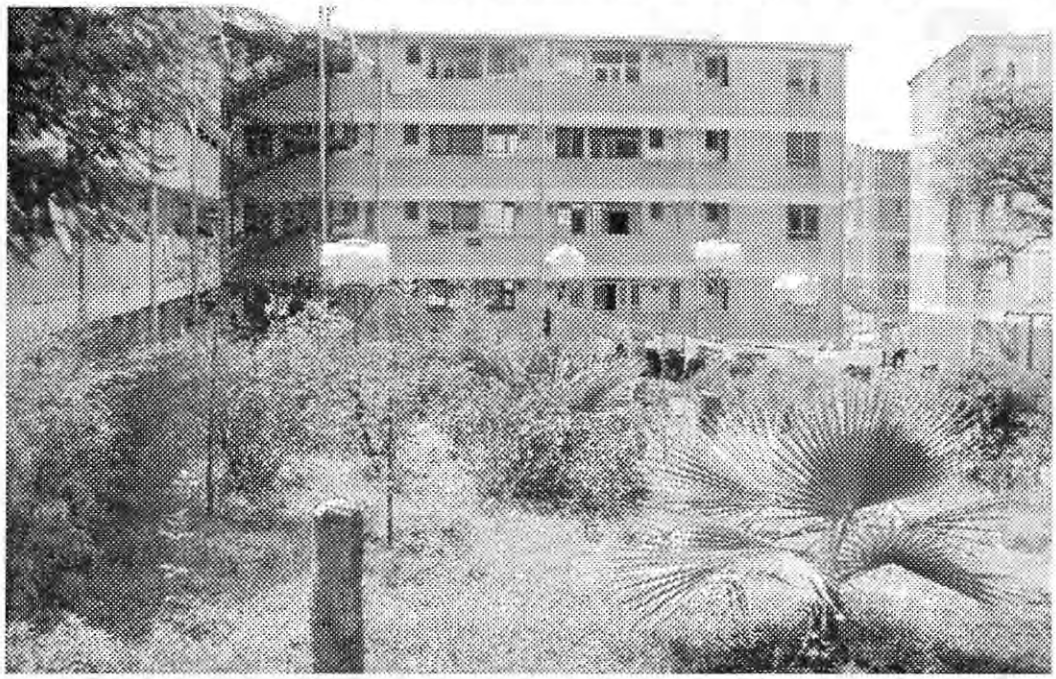
Other sources of water	Frequency	Percent
Packed water	14	22.6
Spring water	6	9.7
River water	9	14.5
Water from wells	9	14.5
Other places like nearest Keble	24	38.7
Total	62	100.0

Source: Field Survey, 2013

The above table revealed that, 38.7% said they have got from other places like the nearest Keble's, 22.6 % by purchasing packed water whilst 14.5% of the household, fetching water from rivers and from wells to their households. The remaining 9.7 % of them got water from springs.

Beside, during my field observation and according to focus group discussion made with residence committees, they have got water by storing when water comes through their water taps. In Mikililand condominium there are many water tankers seen in most buildings. Residents complained that unless those individuals tanker filled, water can not reach to 3rd and 4th floors. You can see the following figure.

Figure 8: Water storage in Mikililand condominium sites of Kolfe keranio Addis Ababa



Source: Survey of February 2013

3. Cost of water in condominium housing units

In addition, the respondent households were asked about how much they pay on the average as water bill per month in their condominium residence water supply. The households are billed according the litres of water used per month. The issue of water tariffs is however a controversial one in the study area. Whilst some people believe that they are being paid much, others are enjoying under- billing. And the survey showed in the above table 20 that, majority of the households (50%) have their monthly water bills in the 10-20 Birr category. 23.2 % of the households also pay between 21-30 Birr; 15.7% pay between less than 10 Birr and 4% payoff them between 41-50 Birr as their monthly water bills. More over, 8(4%) and

7(3.5%) of the respondent households paid 41-50 and 51-60 Birr respectively whilst 5(2.5%) paid above 61 Birr per month.

Table 20: Average payment for water per month in condominium housing units

Average payment per month	Frequency	Percent
less than 10 Birr	31	15.7
10-20 Birr	99	50.0
21-30 Birr	46	23.2
31-40 Birr	2	1.0
41-50 Birr	8	4.0
51-60 Birr	7	3.5
above 61 Birr	5	2.5
Total	198	100.0

Source: Filed Survey, 2013

According to the interview made with the Addis Ababa water and sewerage authority officials and the source of AAWSA profile the water tariff system treated its customers in two ways, i.e., for domestic and non domestic customers. Those domestic customers are treated in a progressive tariff system including residents of condominiums. It means, if a household consumes 40m3 of water in a month, it will pay Birr 1.75m3 for the first 7m3, Birr 3.80 for the its 8-20m3 consumption and Birr 4.75 for the rest of its consumption. The following table shows water tariff system of domestic customers.

Table 21: AAWSA water tariff

Tariff block	**Monthly water consumption**	**Tariff**
Block1	0-7m3	1.75
Block2	8-20m3	3.80
Block3	21-40m3	4.75
Block4	41-100m3	5.95
Block5	101-300m3	7.45
Block6	301-500m3	9.3

Source: AAWSA Profile, 2012

In my observation, I found that it was very difficult to get the correct bills from the households and their bills were either irregular or the last bill was so many months ago. According to the interview made with the Addis Ababa water and sewerage authority

officials, the tariff system of domestic customers is not substitute the cost of the water and the authority subsidize the residents. In addition, there is a problem of unsettled bill because most residents of condominium units are rented from owners. Resident committees said no problems in relation to water tariff.

Those respondent households that respond the water they fetch is not sufficient to meet the requirement of their households above are forced to buy water from water vendors out side their condominium unit.

Table 22: Cost of Water from Vendors and its labour cost

Price of 1jerica (20 litres) of water from water sellers	Percentage	Frequency	Labour cost to carry 1jerica (20 litres) of water	Frequency	Percent
Less than 1 Birr	15	9.1	Lessthan3 Birr	4	2.5
1-2 Birr	88	53.7	3-6 Birr	101	62.0
3-4 Birr	12	7.3	6-9 Birr	25	15.3
4-5 Birr	29	17.7	10birr and above that	29	17.8
8-9 Birr	20	12.2	Other (own labour)	4	2.5
Total	164	100.0	Total	163	100.0

Source: Field Survey 2013

The survey results have shown in table 22, that 53.7% of the households paid between 1-2 Birr per a jerica/baldi (20 litres of water container). 17.7% of households paid between 4 Birr to 5 Birr, 12.2% paid 8to 9 Birr and another 9.1% paid less than 1Birr; last but not least 7.3% paid 3to 4 Birr, for same amount of water sold by vendors.

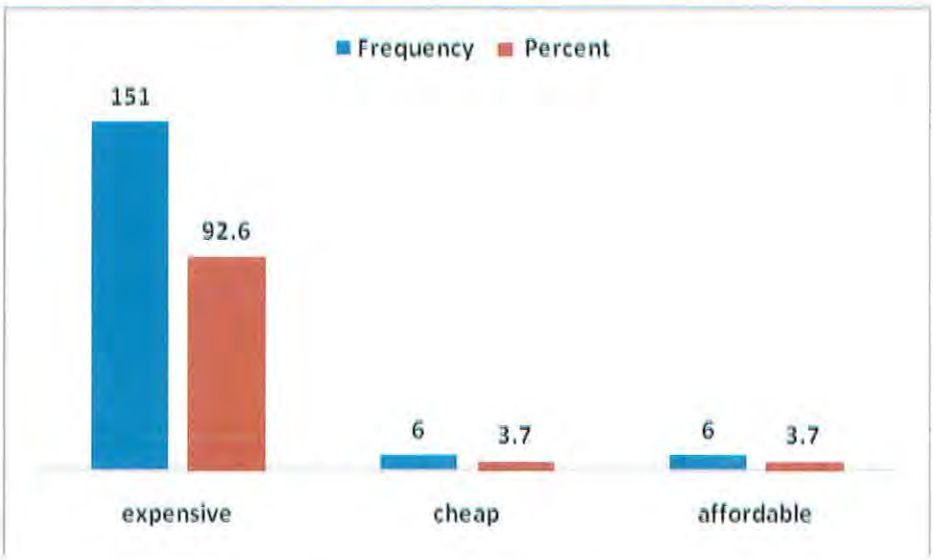
Besides, regarding the labour cost is concerned, respondent households were asked about how much they pay for labour to carry one Jerica/Baldi (20 litres of water) from out side to the households condominium units. And the survey showed that, 62.0% of the respondent household paid between 3 to 6 Birr, 17.8% of them paid 10 Birr and above, 15.3% of the household paid 6 to 9 Birr and the remaining 2.5% of the households paid less than 3 Birr and the same percent of them used their own household labour.

In relation to this, when we see the situation of water collection vs. gender, the survey showed the gender distribution of the households is 67 (33.5percent) and 133 (66.5percent) are male headed and female headed households respectively. Here the number of female headed house holds 66.5percent. This number has its implication in water collection and water issues.

In my field observation I saw that, the burden of water is mainly borne by women. In total women are responsible for water collection in most of the households. The fact that young girls are the primary water collectors has implications on their ability to pursue education and on their career development. Women and young girls in the poorest households are more affected by water collection while richer households have the possibility of engaging house servants to undertake this activity.

Besides, many households believe that the price of water per trip from the vendors a jerica/baldi (20 litres of water container) is not affordable, is expensive. During the period of the survey, as much as 92.6% of the households agreed, as in Figure 9, that water per trip was expensive. On the other hand, 3.7% said it was affordable whilst 3.7 % agreed that, it is cheap.

Figure 9: Affordability of Water from water Vendors



Source: Field Survey 2013

One important point that the survey shows there is water price and labour cost variation from site to site in each sub city. Most of the households in Dandi Boru site of Kirkos sub city Paid 10 Birr and above for labour cost and 8 to 9 Birr for a jerica of 20 litres of water, whereas in Mikililand site of Kolfe Keranio and in Menen of Gulele sub city most of them paid 3 to 6 Birr for labour and 1 to 2 Birr for water. You can observe the situation from the following table.

Table 23: Water price and labour cost in each site

Water price	Name of respondents condominium site				Labour cost	Name of respondents condominium site			
	Mikilild	Dandi Boru	Menen	total		Mikilild	Dandi Boru	Menen	Total
Less than 1 Birr	11	3	1	15	Lessthan3 Birr	2	0	2	4
1-2 Birr	71	2	15	88	3-6 Birr	79	12	10	101
3-4 Birr	8	4	0	12	6-9 Birr	23	0	2	25
4-5 Birr	16	13	0	29	10 Birr & above that	0	28	1	29
8-9 Birr	2	18	0	20	Other, own labour	4	0	0	4
Total	108	40	16	164		108	40	15	163

Source: Filed survey, 2013

In addition, the toilet facility and its water consumption of the respondents condominium housing unit is concerned, respondents were asked whether they had a toilet or not in their housing unit. The survey data showed that, all respondents i.e., 200(100.0%) had toilet in their housing unit.

The survey data further showed that, all the respondents of condominium housing unit has toilet facility of flash type. In relation to this, the survey further showed that the water consumption of this flash type of toilet that; 155(77.5%) of the respondents replied that their flash type toilet consumes much water, 23(11.5%) of them responded that it consumes small amount of water and 22(11%) of the household replied I don't know.

Table 24: Condominium housing unit toilet water consumption

Condominium Toilet water consumption	**Frequency**	**Percentage**
Much	155	77.5
Small	23	11.5
Don't know	22	11.0
Total	200	100.0

Source: Field Survey, 2013

Regarding bath facility, the survey also showed that all (100%) of condominium housing residents have separate bathing facility in their condominium unit.

4. Quality of water & sanitation facility in Respondents condominium housing unit

Respondents are also asked of their opinion on the quality of source of water and sanitation facilities. The survey result displayed that, over all, 64% judged the quality of the water as being good, 36% reported not good quality by citing the following reasons.74.1% the respondent reported that of the water is not clean having some particles inside; 8.2% are of the view that the water was having some residue algae and black in colure; whilst some 5.9 % said that it had some bad odour or smell. 1.2% of the respondents said that, it is not clean because of rust of pipelines. We can see from table 25 below.

Table 25: Quality of source of water and sanitation facilities

List of quality problems	Frequency	Percent
Is not clean, there is some dirty particles in it.	63	74.1
Some residue in it & black in colure	7	8.2
Have some sort of bad odour	5	5.9
Algae	7	8.2
Not clean because of rust of pipelines	1	1.2
Total	85	100.0

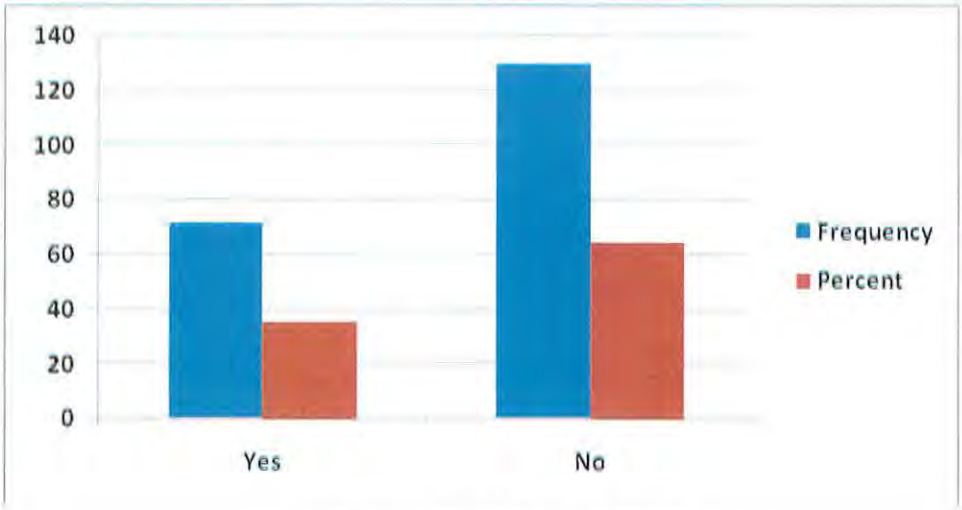
Source: Filed Survey

4.4. Major challenges of water supply in previous and current residences of households

4.4.1. Challenges of water supply in Respondents Previous Residence

Regarding the existence of problems in respondent's previous housing water supply, respondents were asked whether there were water problems or not. Then, the survey data showed that, 129 (64.5%) of the household respondents hadn't water supply problems in their previous residence. The remaining 71(35.5%) of respondents had water supply problems before.

Figure 10: Previous Water supply problems



Source: Field Survey, 2013

Most of the household respondents of the survey replied that there were varieties of water supply problems in their previous housing. Table 26 showed that the list of problems in previous residence of respondents. The survey result in this table demonstrates that 60(49.2%) of the total respondent households said that water interruption were the major problem and 13(10.7) of the total respondents replied they did not got water any time they want because water pipes were not their own. Further more, 11(9.0%) of the total households respondents said that water quality is the main problem.

In addition, table 26 demonstrates that out of the total sample household 10(8.2%) said that water shortage (amount), 8(6.6%) of them said irregular timing in distribution, 6(4.9%) of the total respondents said pipe line breakage, 5(4.1%) of the respondents replied long queue for water and 4 (3.3%) water purchase from vendors were the main problems that were faced in their previous residence. The last but not the least 3(2.5%) and 2(1.6%) of the total sample household respondents reported that walking long distance to fetch water and old pipe lines and network were their problems in their previous housings.

Table 26: List of water problems in previous residences

List of water problems	Frequency	Percentage
Water interruptions	60	49.2
Quality problems	11	9.0
Water shortage(amount)	10	8.2
Irregular timing in distribution	8	6.6
Water purchase from vendors	4	3.3
Can not get water any time you want, pipes are not Private	13	10.7
Pipe line breakage	6	4.9
Walking long distance to fetch water	3	2.5
Old pipe lines and net work	2	1.6
Long queue for water	5	4.1
Total	122	100.0

Source: Field Survey, 2013

In general, in previous residence water supply, there were so many problems. As the findings from the survey, the problems are: water interruptions, water quality problems, shortage in amount of water, irregular timing in water distribution, water purchase from water vendors, pipe line breakage, walking long distance to fetch water, old pipe and net work and long queue for water fetching.

Based on the Focus group discussion made with condominium residence committees, the major problems of water supply before they came to condominium was for some too much time is being wasted in search of water, for public stand pipe/Bono/water users there was long queues in fetching water, resulting in quarrels as a problem.

Based on the interview made with AAWSA officials however, they did not agree to the statements that long queues in fetching water in Addis Ababa except in some expansion areas of the city.

As the above table clearly shows, the major problem of previous water supply were water interruptions. Regarding the frequency and the average duration of water interruption concerned, in the survey 52(37.4 percent) of the total respondent households reported that, there were water interruption of 1 to 2 times in a week, whereas 57(41.0 percent) of the households said there were water interruption one or two times in a month, further more, 16(11.5%) of the total household respondents reported that there were water interruption 3or

4 times in a week and others, 9(6.5%) replied that there were water interruption 1to 2 times in a week. Last not least, 5(3.6%) reported that there were water interruption 3or 4 times in a month. In such conditions, they were forced to fetch water from some where else out side their home.

Respondents were asked what was the source of water in such conditions and how far did they got to fetch water in their previous housing and how many times they fetch water. Regarding the source during interruptions, the survey showed that, the major sources for 83(52.2%) were neighbouring Keble and for 47(29.6%) tankers or any other container in their homes (reservoir). Besides, wells 9 (5.7%), springs 7(4.4%), and rivers 6 (3.8%) were the other sources of water during interruptions in their previous residence.

Concerning distance to fetch water and how many time they fetch water, most of the respondents reported that they weren't go far distance. As table 27 showed, they did not go more than 200 meters. From the total respondent households 79(71.2%) go less than and equal to 200 meters to fetch water in their previous residence. Only 12(10.8%) of the total household respondents were go above700 meters.

Table 27: Distance to fetch water in previous residence

Distance	Frequency	Percent
Less than and equal to 200 meter	79	71.2
300-600meter	8	7.2
700-900meter	12	10.8
Above 900 meter	12	10.8
Total	111	100.0

Source: Field Survey, 2013

The survey data also showed that how many times they fetch water in the previous residence. It showed that 22(39.3percent) of respondent households fetch water one times, 21(37.5percent) of them fetch two times 5(8.9 percent) 3times and 4(7.1 percent) of the respondent households at reported that they fetch more than that.

During water interruptions in previous residence households were forced to buy water from outside their home. Regarding this issue problem in respondent's previous housing water supply, respondents were asked and reported that, 85 (75.2%) of the household respondents bought 20 litres of water with less than 1 Birr in their previous residence. 22 (19.5%) of them replied that they were bought 20 litres of water with 1to 2 Birr. The remaining 6(5.3%) of respondents were bought 20 litres of water with3to 4 Birr.

However according to the judgement of the AAWSA officials, certain assertion like high water prices from vendors; wastage of too much time in search of water; children risking their lives when crossing the roads to fetch water are all minor problems in the water problem deliberation. They also did not agree to the statements that risk in drinking untreated water were impacts of the water problem.

In addition, both category of respondents i.e., household water consumers and Addis Ababa water and sewerage Authority officials, absolutely agreed that there were problems associated with water supply system in previous residence of respondents.

There fore, the causes of water supply problems in the previous residence of respondents were many. The itemised list in table 28 was presented to the households to indicate their rankings.

93% of the respondents were of the view that one of the major causes of the water supply problems in the area was due to electric power interruption, 42.5% of the respondents were of the view that of the major cause was due to the insufficient water supply which has effect on water supply their residence.39% of the respondents reported that the major cause was due to few pipe line can not support the fast expansion of the township, which the few old existing pipelines cannot support. 36% of them were suggested the cause was from the frequent broken down pipe lines of the AAWSA. 29.5% argued out that the lack of support and provision from stakeholders might be one of the main causes, whilst 25.5% has the belief that part of the main cause might be due to the financial shortage and 22% has a belief that the cause might be illegal connection.

More over, apart from the major causes, 33.5% were of the opinion that frequent broken down of pipe lines might be a minor cause of water problems and 31.5% also held the same view in terms of few pipe lines can not support fast urban expansion. In another ranking, 64% and 53% rejected the assertion that illegal connection and financial shortage could be a cause to water shortage problems respectively.

When the officials of the Addis Ababa water and sewerage authority were interviewed on the issue, some of the major causes of water supply problems in the area were mentioned as electric power outage problems; the lack of financial shortage to carry out maintenance and expansion work on their system; topography, fast urban expansion, failure of water infrastructure and electro mechanical system. They believed the possible minor causes might be; lack of expertise knowledge and skills and Illegal connections problem.

Table 28: Possible Causes of Water Problems

Water Issues	Sever cause		Minor cause		Not a cause	
	Frequency	%	Frequency	%	Frequency	%
(1) Insufficient water supply	85	42.5	59	29.5	56	28.0
(2) Frequent broken down of pipe lines	72	36.0	67	33.5	61	30.5
(3) Few pipe lines cannot support fast urban expansion	78	39.0	63	31.5	59	29.5
(4) Illegal connections	44	22.0	28	14.0	128	64.0
(5) Lack of support and provision from stakeholders	59	29.5	54	27.0	87	43.5
(6) Financial shortage	51	25.5	43	21.5	106	53.0
(7) Electric power interruption	93	46.5	57	28.5	50	25.0

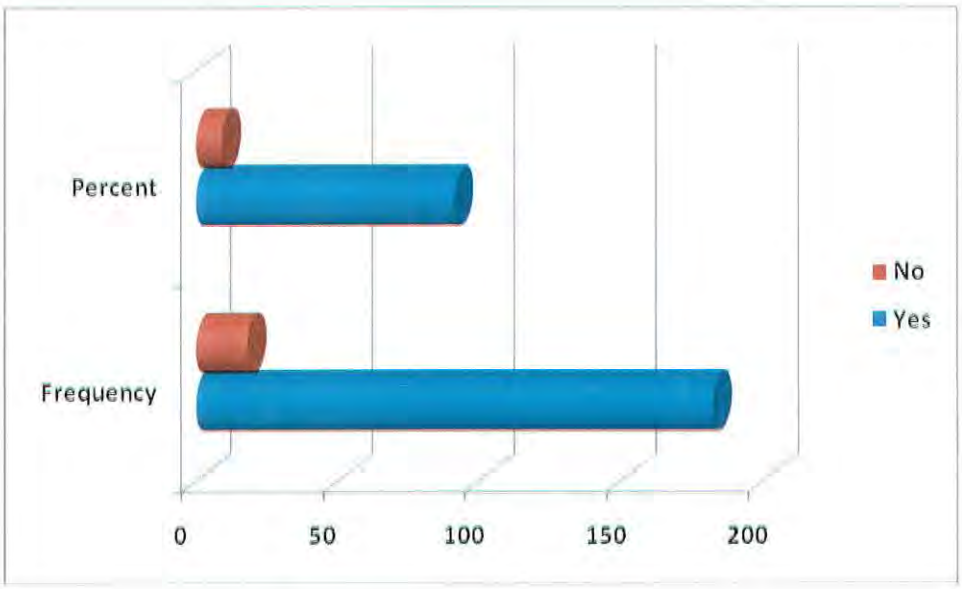
Source: Field Survey, 2013

4.4.2. Challenges of water supply in Condominium housing units

Here also both household respondents (water consumers) in the survey and in an interview made with Addis Ababa Water and sewerage Authority officials absolutely agreed that there were problems associated with water supply system in the study areas of condominium unit. In the survey, for those households asked about water supply problems in their condominium unit as compared with their previous residence and it appear 81.5 % of the households indicated problems with the water supply system in their condominium unit water supply. 18.5% of them said there were no problems.

Water supply interruptions / irregularity are one of the major problems that frequently faced condominium household's water supply. The respondents of condominium housing units were asked whether there is any water supply interruption/irregularities/ in their condominium unit of residence. Then, 182(91%) of them replied that there is water interruption /irregularity/ in condominium housing water supply, whereas 18(9%) of them reported that no water interruptions in their unit. You can see from figure 11 below.

Figure 11: Water supply interruption in Condominium housing unit



Source: Filed survey, 2013

In the survey, regarding the average duration of water interruptions in condominium housings is concerned, 57(28.9%) of them replied that water available for 1day or 2 days in a week and interrupted in the other days; 34(17.3%) of the respondent households also said water available from four days only one day and interrupts; and 24(12.2%) of them said water available with two days interval and no water in day time for 3 to 4 days in a week. More over, 12(6.1%) of respondents reported that water interrupt 1 day in a week but no water always at the middle of the day; 11(5.6%) of them said water available 1day and the other 6 days no water in the pipe, also 6 days available and 1 day no water especially in day time. Last not least, 8(4.1%) and 4(2%) of respondents said water available all the week but interrupt at the middle of the day and water available with 1 day interval respectively.

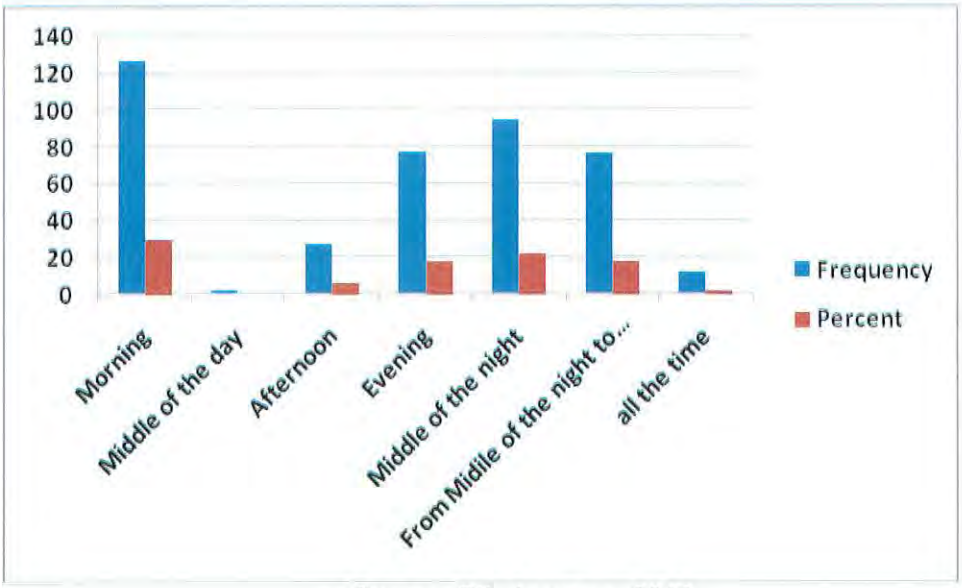
Table 29: Average duration of water interruptions

Average duration of water interruptions	Frequency	Percent
Water available 1day and no water in the other 6 days	11	5.6
Water available from 4 days only one day and interrupt	34	17.3
Water available for 1 day or 2 days in a week & interrupted the other days	57	28.9
Water available with 1 day interval	4	2.0
With 2 days interval water available	24	12.2
6 days available, no water 1 day especially in day time	11	5.6
Water available all the week but interrupt at the middle of the day	8	4.1
Water interrupt 1 day in a week but no water always at the middle of the day	12	6.1
No water in day time for 3-4 days in a week	24	12.2
Other (interrupt half a day, interrupt two times a day, ...)	12	6.1
Total	197	100.0

Source: Filed survey, 2013

In the survey respondents also asked about time variation in the availability of water in the pipe and 190(95.0%) of them responded that there is variation in the availability of water and the remaining 10(5.0%) do not agree with this and responded no. Respondents asked and further answered that at what time water is always available. As we see from the Figure 12, 126(30.4%) of the household responded water is always available in the morning, 94(22 &%) of them reported water is available at the middle of the night; 77(18.6%) of them answered water is always available in the evening and 76(18.4%) of the household responded that it is always available from middle of the night to morning. In addition, 27(6.5% and 12(2.9%) of the household said that water always available in the afternoon and all the time respectively. The remaining 2(0.5%) of households responded that water is always available at the middle of the day. We can observe from Figure 12 below.

Figure 12: Time variation in availability of water

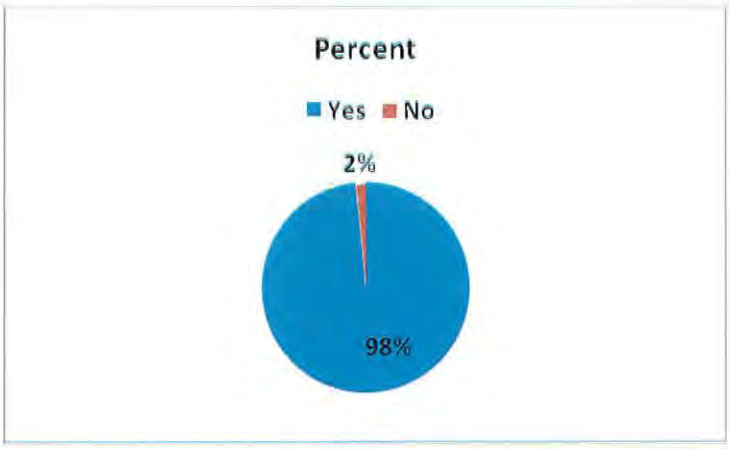


Source: Filed survey, 2013

Respondents further asked regarding the availability of water supply always in each respondents condominium floor and responded that 166(83%) of them said water is not always/ all the time / available in my floor; the remaining 34(17%) of the respondents said there is water supply always in their floor.

The survey data further showed that there is variation in the amount of water supply in each floor of the building. From the total 200 household respondents, about 197(98.5%) of the households agreed that there is variation in amount of water supply in each floor of the building; whereas 3(1.5%) of the household responded no variation in amount of water supply. You can see from the following Figure.

Figure 13: variation in the amount of water supply in each floor of the building



Source: Field Survey, 2013

In conditions of water interruptions, condominium household respondents were forced to fetch water from some where else out side their home or bought packed water or use from they stored in their home. Respondents were asked about the source of water in such conditions. Regarding the source during interruptions, the survey data showed that, the major sources were neighbouring Keble 153(68.6%) and tankers or any other container in their homes (reservoir) 35(15.7%). Besides, packed water 16 (7.2%), wells 11(4.9%), and springs 4 (1.8%) are the sources of water during interruptions in condominium residence unit.

Table 30: Sources of water during the interruption in condominium housing unit

Types	Frequency	Percentage
Neighbouring Keble residents	153	68.6
Springs	4	1.8
From tankers/other containers stored	35	15.7
Wells	11	4.9
Packed water	16	7.2
Other	4	1.8
Total	223	100.0

Source: Field Survey, 2013

The respondents were asked to rank the level/degrees of the problems in terms of sever problem, minor problem, not a problem. As table 31 showed, water shortage due to interruption, heavy burden /work load/ of women in the households, sanitation problems due to water irregularity are sever problems in condominium housing units.

Further more, table 31 shows, 68.5 % of the respondents were of the view that one of the sever problems the water shortage in the area is due to the repeated water interruption, 21% of the respondents reported as water shortage due to water interruption is a minor problem and10% of them said not a problem. 68% of them were suggested sanitation problems due to water interruptions is a sever problem, 26% of the responding households replied it is a minor problem and the other 6% agree as not a problem.

62.5 % argued requirement of additional man power for water collection might be one of the sever problems, whilst 26% has the belief that it is a minor problem and the rest 11.5% believed that it is not a problem. In addition, 69 % of the household respondents also revealed another severe impact as work load of women in the households becoming extra

heavy. They believed this is so because women are already overburden with a lot of domestic unpaid activities, and that the water problem have aggravated their situation as they have to use extra time and energy to make sure water is available in the home for the spouse and the children. But 25% of the households believed as a minor problem and the remaining 6% believed that it is not a problem.

In other rankings, 63% of the respondents noted high water prices from water vendors as a major problem, 16.5 % agree as it is minor problem and 20.5% said is not a problem. 35% also had the same view for children risking their lives when walking across streets to search for water, whilst 39% is not agreed with this. Besides, 51.5%and 45.5% of households believed that leakage and children risking their lives when walking across streets to search for water are not a problem.

Table 31: Degrees/levels of Problems of Water supply & delivery in condominium housing units

Issues of water supply and delivery	Sever problem		Minor problem		Not a problem	
	Frequency	%	Frequency	%	Frequency	%
Water shortage due to interruption	137	68.5	42	21	21	10
Sanitation problems due to water interruption /irregularity/	136	68	52	26	12	6
Requirement of additional man power for water collection	125	62.5	52	26	23	11.5
Work load of women in the households becomes very heavy (burden on women's)	138	69	50	25	12	6
Drainage & sewer pipes busting and blockage	124	62	57	28.5	19	9.5
Serious Leakage Problem	50	25	43	23.5	103	51.5
High water prices from water vendors during interruption	126	63	33	16.5	41	20.5
Children risk their lives crossing roads in collecting water	70	35	39	19.5	91	45.5

Source: Filed Survey, 2013

The causes of water supply problems in the study area are many. The itemised list in table 32 was presented to the households to indicate their rankings. The respondents were asked to rank the causes of the problems in their condominium residential units. 41.3% of the respondents were of the view that one of the major causes of the water scarcity in the area was due to the insufficient water source. 18.6 % of them were suggested the cause is few pipe lines cannot support fast expansion of urbanization. 8.6 % argued out that the frequent broken down of pipe lines might be one of the main causes, whilst 6.8 % has the belief that part of the main cause might be due to the water has no power to reach in the upper floor. Further, 5.6 % has the belief that part of the main cause might be due to the lack of AAWSA technical expertise.

Apart from the above causes, 5.0% were of the opinion that Electric interruption/ Electricity power outage problems/might be a minor cause of water problems and 1.8% also held the same view in terms financial shortage. In addition, Absence of reservoir (0.9%) absence of coordination between different offices (0.6 %) whilst road and other construction works (0.3%) are also possible cause to water shortage problems.

When the officials of the Addis Ababa water and sewerage Authority officials and expertise were interviewed on the issue, the most sever and major causes of water supply problems in condominium housings were mentioned as their responsibility is to supply water up to 1meter bar (10 meter height or up to G+2); absence of reservoir and there is no an elevated tanker in condominium housings; pressure problem; repetitive electric interruption/ electricity power outage problems/and failure of water infrastructures and electromechanical parts; topography of the land specially for those condominium housings found in the Northern part of Addis Ababa, designs of condominium housings, fast expansion of the city and wide infrastructure development and absence of coordination between different offices are the major causes of water supply problems.

According to them, they believed that the possible minor causes might be administrative and legal issues like the problem in procurement directives which delay the supplying of spare parts, lack of expertise and skilled manpower, technology, finance, absence of the habit of water saving from the household side are from be causes of the water problems.

Table 32: Possible Causes of Water Problems

Possible Causes of water problems	Frequency	Percentage
Insufficient water source	140	41.3
AAWSA lack technical expertise/technicians	19	5.6
Frequent broken down of pipe lines	29	8.6
Few pipe lines cannot support fast expansion of urbanization	63	18.6
Lack of support & provision from stakeholders	11	3.2
Financial shortage	6	1.8
Electric interruption/ Electricity power outage problems/	17	5.0
No power to reach in the upper floor	23	6.8
Road and other construction works	1	.3
Absence of coordination between different offices	2	.6
Absence of reservoir	3	.9
Total	339	100.0

Source: Field servey, 2013

In short, based on the interview made with officials of AAWSA, inadequate finance and man power, weak coordination among different offices, failure in implementing what we plan effectively to increase the provision of water and sanitation service, rapid population growth that demand our service are the major challenges in supplying water to residence of Addis Ababa in general and Condominiums in particular. For instance, absence of integration and coordination among offices of road authority, electric power agency, water authority and Telecommunication Corporation is a major problem that causes a hindrance in supplying water for the household.

4.5. Major Opportunities of Water supply in previous and current residences of household respondents

4.5.1. Opportunities of Water supply in Respondents Previous Residence

When we see the opportunities of respondents previous residences water supply as compared with the current condominium housings units, respondents reported that the following lists were opportunities of the water supply and delivery system in their previous residence. Having clean and enough amount of water, availability of water all the day and time, absence of repetitive water interruptions as compared with condominium, absence of shift based water distribution were some of the major opportunities in previous residence of households.

As we can see from the table 33 below, 35.7% of the respondents said they had clean and enough amount of water in their previous house and 5.6% of the respondents replied it was similar with the current water supply facility. On the other hand, 26.9% of the respondent

households believed that the previous water supply situation did not have any opportunity.

Table 33: List of opportunities of water supply in Respondents Previous Residence

opportunities	Frequency	Percentage
Clean and enough amount of water	89	35.7
Always water availability	46	18.5
No repetitive water interruption as compared with condominium	21	8.4
Similar with the current condo house water supply	14	5.6
No rationing/shift/ for having water	1	.4
No need of pressure buster	1	.4
It is not tiresome and no need of additional man power	1	.4
It was free of charge and financed by the government	3	1.2
No sanitation problem because of water shortage/interruption	2	.8
Availability of water any time	4	1.6
No opportunity	67	26.9
Total	249	100.0

Source: Survey 2013

4.5.2. Opportunities of water supply in Respondents current condominium housings units'

When we see the opportunities of respondents of the current condominium housings units' water supply as compared with previous residences, respondents reported the following lists were opportunities of the water supply and delivery system in their current condominium housings as compared with their previous residence. About 45.7 percent of respondent said the current condominium unit do not have opportunities/strong side/; whereas 23.8 percent of household respondents reported it has opportunities of having our own individual pipe line in our unit if water is available. On the other hand, 9 percent and 7.6 percent of the respondents replied it had similar opportunity with the previous residence and supply of clean water is its opportunity respectively.

Table 34: The opportunities of water supply and delivery system in condominium housings

Opportunities	Frequency	Percentage
Having our own individual pipe line in our unit if water is available	53	23.8
Supply of clean water	17	7.6
Easily manage by our own	4	1.8
Don' have opportunity/strong /side	102	45.7
Getting immediate responses for our group questions from AAWSA	13	5.8
No quarrel and disagreement in collecting water	8	3.6
Similar with the previous	20	9.0
For water saving	1	.4
No walking for long distance to fetch water	1	.4
Toilet facility	4	1.8
Total	223	100.0

Source: Field Survey 2013

Out of the total household 5.8 percent of the household said getting immediate responses for our group questions from AAWSA is its major opportunity and 3.6 percent of them said no quarrel and disagreement in collecting water in condominium housing units like the previous residence. Moreover, 1.8 percent of them respond that its toilet facility and easily managing our water usage is important opportunist in their condominium housing unit.

4.6. Residents feeling about the water supply challenges and opportunities in previous and current condominium housing units of respondents

4.6.1. Residents feeling about the Challenges in Previous Residence and condominium housing units

Based on the focus group discussion made with the condominium housing residents committees, they feel that the water supply situation of their previous residences with respect to condominium housings, in most cases residents previous housing conditions do not allow individual connections in their homes. On the other hand, in condominium building they have individual connections in their homes and get a better supply of water in terms of the quantity and the quality of water supplied than the previous once unless there is water interruption occurred. People living in condominium buildings generally do not have to buy water except at a time of interruptions. Most importantly, dwellers see that, the challenge in condominium

housings is they need more water than other residential houses. In addition, in condominium housings, the water pressures fluctuate at each level throughout the building and providing water to the upper floors is a necessity and also one of the main challenges of a condominium housing units. Besides, available municipal water pressure, and pressure requirements not only at the upper floor but also throughout the building. Booster pump, pipe materials, plus many other factors are serious challenges in condominium housings water supply. To their knowledge, these challenges were not in the previous residence.

More over, respondent households were presented with the possible impacts of the water problems of previous residence water supply for ranking as listed in table 35 below. In this regard, a large percentage (66.5%) of the households interviewed said the work load of women in the households becomes very heavy in the area because of frequent water interruption. They believed this is so because women are already overburden with a lot of domestic unpaid activities, and that the water problem have aggravated their situation as they have to use extra time and energy to make sure water is available in the home for the spouse and the children. 40.5% of the households interviewed said, children usually are burdened in collecting water and high rates of water losses.

In other rankings, 77(38.5%) of the respondents noted high water prices from water vendors as a severe impact. 61(30.5%) also had the same view for children risking their lives when walking across streets to search for water, whilst 63(31.5%) agreed that inequalities in service provision was also a severe impact. 74(27.0%) of the households also revealed another severe impact as too much time is wasted in fetch of water becoming extra heavy. 53(26.5%) of the households thought of the risk in drinking of untreated water from open wells or surface waters in some cases as a severe impact. The main risk of the use of untreated water might be the incidence of some water related diseases in the area.

Table 35: Possible Impacts of Water Problems in percentages (%)

Water Issues	Sever problem		Minor problem		Not a problem	
	Frequency	%	Frequency	%	Frequency	%
(1) High water prices from water vendors	77	38.5	37	18.5	86	43.0
(2) Too much time is wasted in fetch of water	74	27.0	44	22.0	82	41.0
(3) Inequalities in service provisions	63	31.5	56	28.0	81	40.5
(4) Children usually are burdened in collecting water	81	40.5	45	22.5	74	37.0
(5) Children risk their lives crossing roads in search of water	61	30.5	25	12.5	114	57.0
(6) High rates of water losses	81	40.5	64	32.0	55	22.5
(7) Risk in drinking of untreated water from open wells or surface waters	53	26.5	13	6.5	134	67.0
(8) Work load of women in the households becomes very heavy	133	66.5	34	17.0	33	16.5

Source: Field Survey, 2013

In addition to the problems and challenges of water supply stated in table 32, the following lists in Table 36 below were presented to the households to indicate their feelings /rankings/ of the challenges in condominium housing water supply. Based on that, 66.5% of the respondents were of the view that one of the sever causes of the water supply problems in the area is population growth followed by topography responded by 59.5% of respondents.

57% of the respondents were of the view that the environmental issue of quantity and quality of water sources is the sever cause. 52% of the respondents also reported that the sever cause was institutional challenges of poor governance. On the other hand, 43.5 % argued out that the lack women's involvement might be one of the minor causes, whilst 43% has the belief that part of the minor cause might be due to the NGOs and other stake holder's involvement and % has a belief that the cause might be resident's participation.

More over, apart from the minor causes, 54.5% were of the opinion that lack of knowledge and technical skill might not be a cause of water problems and 37.5% technical /technological challenge of small number of network lines also held the same view.

Table 36: Challenges of condominium water supply

Causes of water problems/ challenges/	Sever cause		Minor cause		Not a cause	
	Frequency	%	Frequency	%	Frequency	%
Institutional challenge :Poor governance,	104	52	79	39.5	17	8.5
NGOs and other stakeholders involvement	60	30	86	43	54	27
Financial: Financial ability /budget problem/	55	27.5	72	36	73	36.5
Willingness and ability to pay for services	31	15.5	71	35.5	98	45
Technical /Technological challenge: Small number of network lines	67	35.5	58	29	75	37.5
Old network lines	83	41.5	51	25.5	66	33
Lack of knowledge and technical skill	36	18	55	27.5	109	54.5
Social issues: Residents participation	52	26	76	38	72	36
Women's involvement,	37	18.5	87	43.5	76	38
Rapid urbanization	110	55	66	33	24	12
Population growth	133	66.5	53	26.5	14	7
Environmental issues: Quantity and quality of water sources	114	57	66	33	24	12
Topography	119	59.5	70	35	11	5.5

Source: Filed Survey, 2013

4.6.2 Residents feeling about the Opportunities of water supply in previous residence and Condominium housing units

When we see the feelings of residents about the opportunities of previous residence water supply, residents responded their feeling that availability of water all the day and all the time, absence of repetitive water interruptions as compared with condominium were some of the major opportunities in previous residence of households. As stated table 26, and 33 above and residents response in most cases there is no rationing/shift/ for having water as like condominium

units. It is not also tiresome and no need of additional man power as condominium housing in the study area.

On the other hand, residents of condominium housing units feel about their water supply opportunities that of having their own individual pipe line in their housing unit and no walking for long distance to fetch water if water is available. Besides, households will get immediate responses for their group questions from AAWSA. Having clean water, no quarrel and disagreement in collecting water in condominium housing units like the previous residence. Moreover, if water is available and easily managing their water usage. These are some of the important opportunist that residents feel in their condominium housing unit water supply.

4.7. Satisfaction level in the water supply and sanitation in current condominium housing unit

Respondents were also asked about their level of satisfaction with respect to water supply and sanitation in their current condominium housing unit as compared with their previous housing condition. About 34.5 % of the respondents are neutral regarding the satisfaction in the water supply and sanitation in current condominium housing unit whereas 30.5% are not satisfied. About 17.5% of the respondents are satisfied and 16% of the respondents also strongly satisfied with their current housing water supply and sanitation facilities.

Table 37: Satisfaction level in water supply and sanitation in current condominium housing unit

Satisfaction level	Frequency	Percentage
Strongly satisfied	32	16.0
satisfied	35	17.5
Neutral	69	34.5
Not satisfied	61	30.5
Strongly unsatisfied	3	1.5
Total	200	100.0

Source: Field Survey 2013

4.8. Interventions to improve water supply services & overcome the problems in the condominium housings of Addis Ababa

As far as intervention to overcome water supply problems or to improve water supply services in the condominium housings of Addis Ababa is concerned, most of the household

respondents of the survey reported that AAWSA should increase the amount and volume of water and some sort of measure should be taken by AAWSA to reach the water up to 4th floor. For instance, water pressure booster/pump/is needed to increase the water pressure in supplying water to the third and fourth floor. Besides, AAWSA should work for the availability of water every day and measure should be taken to supply equally for all residents of condominium units.

These are not the only intervention to solve the problem and improve the service suggested by sample respondents. The following are the other important measure that must be taken to solve the above stated problems; additional water source like water wells should be developed, AAWSA should discus and work with the residents to solve the problem, proper planning, program coordination and continuous surveillance from top to bottom is needed, detail study about the reason for the interruptions and give long lasting solution, AAWSA should work to improve the water quality and the residents committee must communicate with AAWSA and solve the above stated problems.

The survey result shows that 49(16.8%) of the household respondents said AAWSA should increase the amount and volume of water to solve the water supply problems in condominium housing units.

Table 38: Interventions or to improve water supply services & overcome water supply problems in the condominium housings

Interventions	Frequency	Percentage
AAWSA should increase the amount and volume of water	49	16.8
Measures should be taken by AAWSA to reach the water up to 4th floor	47	16.1
Measures should be taken by AAWSA to supply equally for all residents of condominium	36	12.3
Water pressure booster/pump/is needed	31	10.6
AAWSA should work for the availability of water every day	42	14.4
There is repetitive failure in pumps so this needs attention	7	2.4
Proper planning, program coordination and continuous surveillance from top to bottom is needed	7	2.4
Detail study about the reason for the interruptions and give long lasting solution	6	2.1
AAWSA should discus and work with the residents to solve the problem	9	3.1
Residents should save water in their part	3	1.0
Those old pipe lines should be changed	3	1.0

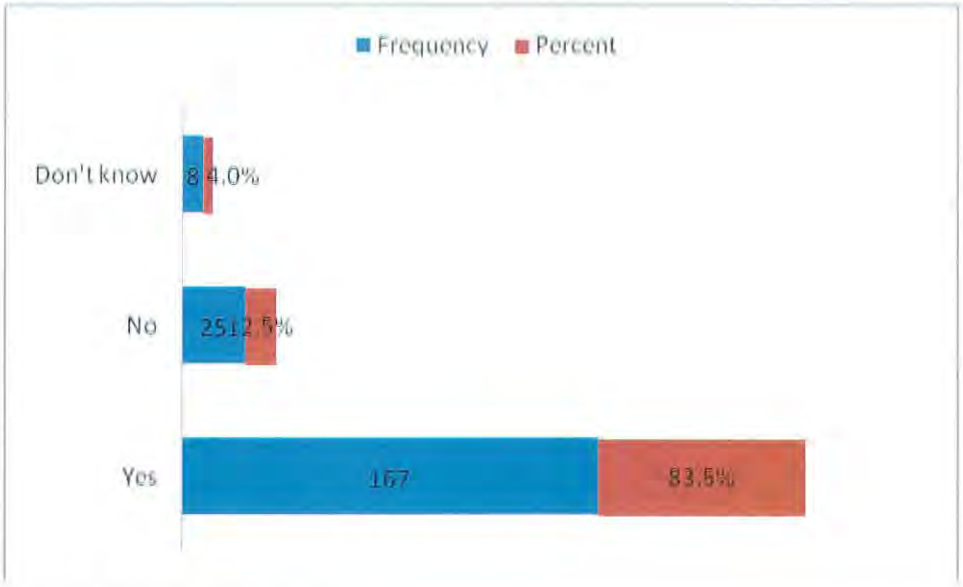
additional water source like water wells should be developed	22	7.5
The residents committee must communicate with AAWSA and solve the problem	5	1.7
Regarding electric power interruption measures should be taken	4	1.4
AAWSA should employ committed workers to serve residents	3	1.0
AAWSA, telecommunication and road authority must coordinate	1	.3
NGOs and religious organizations Must participate to solve the problem	4	1.4
AAWSA should work to improve the water quality	7	2.4
Pumping up motor and reservoir should be facilitated for this kind of buildings	6	2.1
Total	292	100.0

Source: Field Survey 2013

As we see from table 38 above, 47(16.1%) and 42(14.4%) of the respondents said some sort of measure should be taken by AAWSA to reach the water up to 4th floor and it should also work for the availability of water every day respectively.

Broadly speaking, both officials of the AAWSA and the surveyed households of the study area accepted the fact that involving all residents of condominium units and the residents association by the AAWSA would be one of the helpful steps in solving the water problem in these housing units. In figure 14 almost 83.5 % out of the total households interviewed (200) believed the involving residents association by AAWSA were capable of offering some assistance that could result in relieving of the water crisis. 12.5 % of the respondents say involving the residents association could not resolve the problem /could not be of any help/;and 4% respondents we don't know.

Figure 14: Involving residents association in water supply



Source: Field survey, 2013

Respondents are asked whether condominium houses got support from NGOs in relation to water supply or not. 103(51.5%) of the total households reported they didn't get any support from NGOs in relation to water supply and 97(48.5%) of them replied we don't know.

According to the interview made with AAWSA officials, the authority should develop water supply infrastructures further, drill additional wells. In this regard, the city administration has instigated to under take urgent steeps toward boosting water production in line with the city's socio economic development. Hence massive ground water exploitation projects have been under way. The gap between the city water demand especially the need of condominiums residents and supply would significantly reduced. The authority is currently engaged in the drilling of 40 deep wells at Akaki well filed which is expected to yield 14000m3 of water per day. Some of the wells have already been awarded to contractors. This and other important measures are taken by AAWSA to solve the stated problems.

Moreover, for the future, the Authority should participate in the planning phase of condominiums housings and give ideas in some technical maters, educate the households on how to save and use in this kinds of housing units, monitor and control the integration between different offices and must support with some legal frameworks.

Chapter Five: Conclusion & Recommendation

5.1. Conclusions

This part of the thesis is based on the findings that resulted from the study, of which views sampled and information gathered from different parties in condominium housing residents water problem have been categorised and analysed. These key findings will among others revolve mainly around the stated objectives and research questions of the study. This study is aimed to assess the challenge and opportunities of water supply service in Condominium housings of Addis Ababa as compared with previous residence.

In the previous residence of the household of condominium housing residents, the sources of water for the majority of the respondents are from piped to compound followed by water from piped in to dwelling unit. The remaining ones are used water from the source of public stand pipe. Besides, 84.4 percent of condominium households used the same source of water through out the year. But they used alternative sources like purchase from other neighbouring Keble, springs, wells and bono water when water when water interruption occurred.

Most of the respondent's previous residence households used their previous residence water for drinking, cooking, bathing and washing whereas some respondents were using for toilet and in some cases for gardening purposes. In addition, for most respondents the amount of their previous average daily water consumption was between 81 and above litres of water per day.

In general, in previous residence water supply, there were so many problems. The major problem was water interruption which occurred for most housing units one or two times in a month followed by water supply interruption for 1to 2 times in a week. One of the major causes of the water supply problems (water interruption) in the area was electric power interruption. Besides, water quality problems, shortage in amount of water, irregular timing in water distribution, water purchase from water vendors, absence of water any time they want because of water pipes were not their own, pipe line breakage, old pipe and net work and long queue for water fetching were water supply problems faced residents.

Regarding toilet facility in previous housing unit, most used types of toilet facility was hole in ground type of toilet. For 79.0% households of the previous housing units, water and sanitation facility were good. On the other hand, the previous residence water supply situation had its opportunities. Having clean and enough amount of water, availability of water any all the day and time, absence of repetitive water interruptions as compared with

condominium, absence of shift based water distribution were some of the major opportunities in previous residence of households.

When we see the water supply situation in condominium housing units, there is still a big gap between the supplies and demands of water supply services. This is due to inadequate waters source, inadequate finance, and inadequate man power, weak coordination among the offices and failure to implementing the policies, rapid population growth, absence of participation of the condominium house residents, and some other challenges in the study area. As the gap between demand and supply is rapidly increasing from day to day, the AAWSA will be unable to meet the rapidly increasing water supply needs of the study area unless investments are put in place to augment the water supply system.

In the condominium housing units, all housings are connected to the water supply system. No housing unit is with out pipes connected to their homes. But frequency of flow of water has been a major concern for the households of condominiums. Regarding the frequency of tap flow, for most of the households, water flows mainly on 1 -2 days in a week or maximum of 2 days in a week.

The water supply of adequate quantity and acceptable quality is one of the basic needs of human beings, but the provision of water in condominium housing units has been inefficient.

The amount of water condominium households consumed per day appears for most of households more than 100 litres i.e., 5jericas/baldi (20 litres size) of water per day for their drinking, bathing, washing, cooking , toilet flash and corridors flower. This distribution may be based on the household size and what water is used for in the household. The distribution system is inefficient. The major constraints of distribution system identified are low density of pipelines network, absence of reservoirs and inadequate pressure in the pipe. As a result, water consumption is affected in these areas due to these physical factors in addition to socio-economic factors such as population growth, household income and size that affected their water consumption.

Condominium housing residents mostly use the same source of water throughout the year that is the one provided by the municipality to their condominium unit and majority of the households paid 10-20 Birr in bills for their monthly water consumptions.

One important point that the survey shows there is water price and labour cost variation from site to site in each sub city. Water supply interruptions / irregularity are one of the major problems that frequently faced condominium household's water supply. The average duration of water interruptions in these areas is water available for 1day or 2 days in a week and

interrupted in the other days. But, in conditions of water interruptions, condominium household respondents were forced to fetch water from some where else out side their home or bought packed water or use from they stored in their home.

The other major causes of water scarcity in the area is insufficient water source, few pipe lines cannot support fast expansion of urbanization. In addition, the possible minor causes of the water problems are administrative and legal issues like the problem in procurement directives which delay the supplying of spare parts, lack of expertise and skilled manpower, technology, finance, absence of the habit of water saving from the household side.

The survey result displayed the quality of the water as being good whereas, the resident's level of satisfaction with respect to water supply and sanitation of current condominium housing unit vs. with their previous housing condition, most of them are neutral and are not satisfied. More over, the survey reviled that most respondents (45.7 percent) believed their housing units do not have opportunities in relation to water supply some others (23.8 percent) of household believe it has opportunities because we have our own individual pipe line in our unit if water is available.

Therefore, the problems of water supply in condominium housing units are multidimensional that imposed different challenges on inhabitants such as lose of time, energy and money. Among the problems identified inadequate water supply, Sanitation problems due to water interruption /irregularity/, requirement of additional man power for water collection, work load of women in the households, drainage & sewer pipes busting and blockage, serious leakage problem, high water prices from water vendors during interruption, children risk their lives crossing roads in collecting water, lack technical expertise to handle the pumps, frequent broken down of pipe lines, few pipe lines cannot support fast expansion of township.

Most importantly, the major challenges of water supply in condominium housings are Institutional challenge (like poor governance, lack of planning at local level, policy & legal framework, institutional capacity& support, NGOs and other stakeholders involvement); Financial challenges (high cost of pumping, willingness and ability to pay for services); Technical /Technological challenge (lack of knowledge and technical skills, selection of appropriate technology & availability); Social issues (residents participation, women's involvement);Rapid urbanization, Population growth and environmental issues (quantity and quality of water sources, settlement pattern and topography).

5.2 Recommendations

To overcome water supply problems or to improve water supply services in the condominium housings of Addis Ababa, AAWSA should increase the amount and volume of water to reach the water up to 4th floor. This is because survey result shows that most household respondents urged AAWSA to increase the amount and volume of water to solve the water supply problems in condominium housing units. Besides, AAWSA should work for the availability of water every day and measure should be taken to supply equally for all residents of condominium units.

These are not the only intervention to solve the problem and improve the service. The following are the other important measure that must be taken to solve the above stated problems; developing additional water source like water wells should be developed, AAWSA should discus and work with the residents to solve the problem, proper planning, program coordination and continuous surveillance from top to bottom is needed. In addition, there is repetitive failure in pumps so this needs a kind of attention, detail study about the reason for the interruptions and give long lasting solution is the primary task of AAWSA. Moreover, AAWSA should work to improve the water quality and must communicate with the residents committee in particular and the residents in general to solve the above stated problems.

In general, the following suggestions may be useful in reversing the existing challenges and in achieving more efficient provision of water supply in the study areas in particular and condominium sites in general together with the above stated recommendations. Thus, the following measures need to be taken:

1. Water tanks/ reservoirs: The other common grievance in condominium housings is the weakness of the inadequate water pressure on the top floor of the buildings resulting in a noticeably weaker water supply at this level. Furthermore, during times of water shortages, families must collect water in buckets and carry them to their flats as there are no water tanks to generate a secondary water supply in case of such emergency. Water tanks will help to minimize such kind of grievance in condominium housing units. In other words, 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 condominium residents to have containers to overcome absence of water supply especially during interruptions.

2. In condominium housings, the water pressures fluctuate at each level throughout the building and must always be considered in system layouts and when choosing equipment and pipe materials. Providing water to the upper floors is a necessity and also one of the main challenges of a high-rise building project. In the future, consideration is needed to building height, available municipal water pressure, and pressure requirements not only at the upper floor but also throughout the building. Booster pump capacity and control, pipe materials, plus many other factors are considered when facing the task of plumbing a tall building. Because these things are serious challenges in condominium housings water supply
3. Employing appropriate technology/technological capacity: Innovative technologies are essential to overcome barriers to water and sanitation service provision. 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. A technology appropriate to boost water in to the upper floors of condominium should be considered. Technological out puts that minimize water flow in showers (shower heads) and flashing water in toilet need serious consideration on consumers side.

4. Financial challenges: government should finance water supply projects that solve the problems of condominium housing water supply. The authority should work for enough budgets to water supply and sanitation improvements.
5. Integration and interaction between institutions and different sectors of the population, at decision-making, executive and participative levels is required to plan and execute actions in a coordinated way.

6. Population growth and urbanization: Population growth and rapid urbanization will create a severe scarcity of water as well as tremendous impact on the natural environment. Therefore, developing water sources that fit with the growing population and urbanization needs the attention of city government.

7. Social issues: Residents participation especially women's involvement is crucially important in water supply issues. It should be born in mind that women are the primary collector of water and are also the first beneficiary of improvement and

should, therefore, be involved in any attempt to improve their water supply facilities and should be involved to enable them to discuss how to use water with saving.

8. Environmental Challenges: Quantity & quality problems of water sources are the most commonly quoted environmental problems of water supply. Regarding quantity problem of water sources, Davis et al (1993) said the continued functionality of water supply schemes depends on a reliable source and system of obtaining water from the source.

9. NGOs, Civil Society and Condominium residents' involvement: They should be involved in the water issues in condominium houses. The groups should be able to provide suggestions as to project priorities and plans of the condominium water supply systems. Management of water supply should be seen as a multi-faceted enterprise and should involve a number of stakeholders to promote constant inter-action between private sector, donors, the government and NGOs to review progress. In addition to this, NGOs should take part in minimize financial burden of the mandated authority. Involving Condominium residents at all levels of water supply program helps to support AAWSA in some aspect.
10. Improvement of monitoring and collection of bills by strengthen the institutional capacity: AAWSA establish effective monitoring and the collection system of correct bills from customers. Additionally, the institutional structure should be staffed with qualified personnel and equipped with required facilities. Because, there are too many unsettled bills of condominium housing customers. Maintenance and expansion can take place if effective monitoring team is formed to help minimise problems and collection of all bills.

11. Water Vendors: A task force should be put in place to educate the local water vendors against selling their water at exploitative prices to their neighbours in case of interruption in condominium housings.
12. Adopting Zonal Approach for Overall Service Improvement: Zonal approach can be successfully adopted for overall improvement of water supply in condominium housing units.
13. Flexibility of rules and regulations: rules and regulations regarding procuring spare parts should be flexible to solve immediate problems of water supply.

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Annex-1

Addis Ababa University

College of Development studies

Centre for Water and Development

Questionnaire for sample condominium household respondents (Water Consumers)

Dear Respondents: This questionnaire is prepared as an instrument to conduct an academic research for the fulfilment the Degree of Master of Art (M.A) in water and Development from Addis Ababa University College of Development Studies.

The main objective of this questionnaire is to get information about the socio-economic characteristics of households and the water supply opportunities and challenges of condominium housings in your area. The research is to assess the challenges and opportunities of water supply service in Condominium housings of Addis Ababa. Therefore, the information you are going to give will help me to assess the challenges and opportunities of water supply in condominium housings vs. your previous residence and to suggest some possible solutions. As such the quality of this study highly depends on the information provided by you. What ever information you provide me will be kept strictly confidential and will not be shown to other persons.

Thank you in advance for your valuable cooperation.

Part I: Household Characteristics

Section A: Personal profile of the respondent

Respondent Number: .....

1. Respondent Address: Sub city_____ Woreda _____Keble_____ Site Name _____Block number_____ housing floor number _____house number_____
2. Household head Sex: (1) Male (2) Female
3. Age of the household head ....Marital status of the household .....Family size (How many are you in your household): .....
4. Educational Level /what is your highest level of education/? .....

Section B: Economic characteristics of household respondents

5. Occupational status (What do you do for a living?) _____Average monthly Income of the household .....

Part II. Water supply situation in Previous residences /before coming to condominium/

6. Where has been your previous residence before coming to condominium housing?
   Sub city_____ Woreda_____ Keble _____ house no____
7. For how long did you live in your previous housing? _____
8. From where you getting water supply in your previous residence? _____
9. Was the water supply in your previous residence had problems? (1) Yes (2) No

10. If your answer for question 9 is yes, what were the problems? _____
11. What was your average daily water consumption in litres? _____
12. Did you use the same source of water throughout the year? (1) Yes (2) No
13. If your answer for Q12 is No, from where else you get water? _____
14. For what purpose you need/use/the water? (1) Drinking (2) cooking (3) Bathing (4) Toilet (5) washing (6) others, specify_____
15. Did you fetch water every day? (1) yes (2) No
16. If your response to Q15 is yes , how many times you fetch water?(1) only once (2) two times (3)3 times (4) If other ,specify _____
17. How far did you go to fetch water in your previous residence? (1) <200m (2) 300-600m (3)600-900m (4)if other specify_____
18. Was there any water supply interruption in your previous residence? (1) Yes (2) No
19. If your answer for Q18 is yes, what are the frequency and the average duration of water interruption?
20. From where do you get water during the interruption?!) Rivers 2) springs 3)wells 4)If other, specify _____
21. If you were bought water outside your house before, how much did you pay and in what type of container?
22. Do you think that, the source of water and sanitation facilities you were using good quality?(1) yes (2) No
23. Did you have toilet in your previous home? (1) Yes (2) No
24. What type of toilet facility does the housing unit have? (1) toilet with flush (2) pit latrine (3) hole in ground (4) If other specify .....
25. If your answer for Q24 is flash toilet ,what do you say about the water consumption in relation to that?(1) large amount (2) small amount (3)Don't Know
26. If your answer for Q24 is No, where did you use toilet service?_____
27. Did you have separate bathing facility in your home? (1) Yes (2) No
28. If your answer for Q27 is yes, what type of bathing facility you had in your home before? _____
29. What will you say about the following issues of water supply in your previous residence? Tick (√) as appropriate in the columns under: Severe problem, Minor problem, not a problem in the table below.

Water Issue	.Severe problem	Minor problem	Not a problem
(1) High water prices from water vendors			
(2) Too much time is wasted in fetch of water			

(3) Inequalities in service provisions			
(4) Children usually are burdened in collecting water			
(5) Children risk their lives crossing roads in search of water			
(6) High rates of water losses			
(7) Risk in drinking of untreated water from open wells or surface waters			
(8) Work load of women in the households becomes very heavy			
(9) Other specify_____			

30. What do you think are the following a possible causes of the water problems (like water interruptions and irregularities in amount and time) in your site? Tick (√) as appropriate in the columns under: Major cause, Minor cause, Not a cause in the table below

Causes of water problems	Major cause	Minor cause	Not a cause
(1) Insufficient water supply			
(2) Frequent broken down of pipe lines			
(3) Few pipe lines cannot support fast urban expansion			
(4) Illegal connections			
(5) Lack of support and provision from stakeholders			
(6) Financial shortage			
(7) Electric power interruption			
(8) Other Specify			

31. List out that if there are opportunities of the water supply and delivery system in your previous residence as compared with your current condominium housings? _____

Part III: Current housing /condominium housing/ water supply situation

32. Do you have pipe connected to your condominium unit? (1) Yes (2) No
33. If your answer for Q32 is yes, how many days does your tap flow in a week? (1) All the week (2) 1-2 days (3) 3-4days (4) 5-7days (5) none (6) other specify_____
34. If your answer is No, how far (in metres or kilometres) does it take you to walk to where you draw / fetch water? _____
35. On the average, in what type of container and how many litres of water do you need for your household per day? _____
36. If you have pipe connected to your home, how much do you pay (on the average) as water bill per month? (1)<50 Birr (2) 50-100 Birr (3)101-150 (4) 151-200 (5) 201-250 (6) other , specify____

37. Is the water you fetch sufficient to meet your household requirements? (1) Yes (2) No
38. What is your average daily water consumption (in litres) as compared with your previous residence? _____
39. For what purpose you need water as compared with your previous residence? (1) Drinking (2) cooking (3) Bathing (4) Toilet flashing (5) car wash (6) all (7) others, specify____
40. Do you use the same source of water throughout the year the one provided by the municipality to your condominium unit? (1) Yes (2) No
41. List down other sources of water, If your answer for Q40 is No_____
42. If you buy water outside your house, how much do you pay (on the average) for one Jerica (20litres) of water? (1)<10 Birr (2) 10-20 Birr (3) 21-40 Birr (4) 41-60 (5) other_____
43. How much do you pay for labour to carry one jerica (20litres) of water from outside to your floor?____
44. Do you think that this water price per trip is expensive or affordable to you? (1) expensive (2)chip (3) affordable (4) Other if any _____
45. Is there any water supply interruption/irregularities/ in your condominium unit of residence? (1) Yes (2) No
46. If your answer for Q45 is yes, what are the frequency and the average duration of water interruption? _____
47. Based on Q 45 above, what do you think the reason for the interruption? (Circle more than one) (1) Insufficient water source(2) AAWSA lack technical expertise /qualified technicians /(3) Frequent broken down of pipe lines(4) Few pipe lines cannot support fast expansion of township(5) Illegal connections(6) Poor quality of scheme construction(7) Lack of support and provision from stakeholders (8) all (9) If Other (Specify)
48. From where do you get water during the interruption?(1) Neighbouring Keble residents (2) springs (3) Rivers (4) If, others specify_____
49. Is there time variation in the availability of water in the pipe?(1) yes (2) No
50. If your answer for Q49 is yes, at what time water is always available? (1) in the morning (2)in the middle of the day (3)after noon (4)in the evening (5)in the middle of the night (6) If other ,specify___
51. In your condominium unit, in which floor you live?(1)) first (2 Second (3) third (4) Fourth (5) ground floor
52. Is there water supply always in your floor?(1) yes (2) No (3) If other, specify _____
53. If your answer for Q52 is No, in which time is water flows and interrupts? _____
54. Is there variation in the amount of water supply in each floor of the building? (1)yes (2) No
55. Do you think that, the source of water and sanitation facilities you are using good quality? (1)Yes (2) No
56. If your answer for Q55 is No, why?_____

57. Do you have toilet at your home? (1) Yes (2) No
58. If your answer for Q57 is yes, what type of toilet facility you have? _____
59. If your answer for Q58 is flush type toilet, how its water consumption? (1) much (2) small (3) Don't Know
60. If your answer for Q58 is No, where do you extract your waste? _____
61. Do you think there are problems with water supply and delivery in your condominium housing as compared with your previous residence? (1) Yes, problems (2) No, no problems (3) Don't Know
62. What will you say about the following issues of water supply in condominium housings? Tick (√) as appropriate in the columns under.

issues of water supply and delivery	Severe problem	Minor problem	Not a problem
Water shortage/interruption			
Sanitation problems due to water interruption /irregularity/			
Requirement of additional man power for water collection			
Work load of women in the households becomes very heavy (burden on women's)			
Drainage & sewer pipes busting and blockage			
Serious Leakage Problem			
High water prices from water vendors during interruption			
Children risk their lives crossing roads in collecting water			
Other (specify)			

63. What do you think are the following a possible causes of the water supply especially in relation to water interruption & irregularities problems in your condominium site? Tick (√) as appropriate in the columns under: Major cause, Minor cause and, Not a cause in the table below:

Causes of water problems	Major cause	Minor cause	Not a cause
Institutional challenge :Poor governance,			
NGOs and other stakeholders involvement			
Financial: Financial ability /budget problem/			
willingness and ability to pay for services			
Technical /Technological challenge: small number of network lines			
old network lines			
lack of knowledge and technical skill			

Social issues: Residents participation			
women's involvement,			
Rapid urbanization			
Population growth			
Environmental issues: quantity and quality of water sources			
topography			
Other (specify)			

64. Do you think there are opportunities of the water supply and delivery system in your condominium housings as compared with your previous residence? If yes, list all oppotunties_____
65. What will you say about the quality of the water that AAWSA supplied to your condominium unit drink? _____
66. Do you think involving the residents association by the AAWSA will be helpful in solving some of your water supply problems? (1) Yes (2) No (3) Don't Know
67. Did dwellers of condominium houses get support from NGOs in relation to water supply? (1)No (2) yes (3) Don't Know
68. If your answer for Q67 is yes, what support did dwellers of condominium houses get from NGOs in relation to water supply?_____
69. What is your level satisfaction with respect to water supply and sanitation in your current housing as compared with your previous housing condition? (1) Strongly satisfied (2) Satisfied (3) Neutrals (4) Not satisfied (5) If other ,please specify _____
70. What do you think ,what can be done to overcome water supply problems or to improve water supply services in the condominium housings of Addis Ababa?_____

THANK YOU FOR YOUR ASSISTANCE AND VALUABLE TIME.

Annex-2

Addis Ababa University

College of Development studies

Centre for Water and Development

For Water suppliers (AAWSA)

Name of Responding Officers _____

Position_____

Educational Level _____

Water supply and sanitation related questions

1. What are the sources of water to dwellers of Condominium housings of Addis Ababa? Is it enough to meet the current and future water demand? How about adequacy and affordability of water to the Condominium housings of Addis Ababa?
2. What are the current official tariff /price per litre of water supply services in the Addis Ababa condominium housings? Is the current tariff/price sufficient to recover costs such as operation, maintenance energy and replacement costs? Does the level of tariff / price discourage or encourage the AAWSA in its efforts to improve services to the residents of condominium?
3. Can you say that there are problems with water supply and delivery services to the Condominiums? If yes, what are the challenges in providing water services to Condominium housings of Addis Ababa? What do you think are the following a possible causes of the water problems in Addis Ababa condominium housing sites?
   - Institutional challenge :(Poor governance, lack of planning at local level, policy &legal framework, institutional capacity& support, NGOs and other stakeholders involvement)
   - Financial: (High cost of pumping, Financial ability to pay O&M cost, willingness and ability to pay for services)
   - Technical /Technological challenge: (lack of knowledge and technical skills, availability & selection of appropriate technology, availability &affordability of spare parts)
   - Social issues :(Residents participation, women's involvement, Rapid urbanization, Population growth,)
   - Environmental issues(quantity and quality of water sources, settlement pattern and topography)
4. What will you say about the following issues of water supply and delivery in the AA condominium housings of Addis Ababa?
   - Sanitation problems due to water interruption /irregularity/,
   - Requirement of additional man power for water collection,
   - Work load of women in the households becomes very heavy (burden on women's),
   - Drainage & sewer pipes busting and blockage,
   - Serious Leakage Problem,

- High water prices from water vendors during interruption,
- Children risk their lives crossing roads in collecting water,
- Frequent broken down of pipe lines
- Few pipe lines cannot support fast urban expansion

5. Do you think there are opportunities of the water supply and delivery system in condominium housings of Addis Ababa as compared with the previous conventional houses?
6. Has AAWSA ever involved with residents association of condominium housing in discussing water supply and delivery issues? Do you think involving the residents by the AAWSA will be helpful in solving some of your water supply problems?
7. What do you think can be done to overcome water supply problems or to improve water supply services in the condominium housings of Addis Ababa?_____

THANK YOU FOR YOUR ASSISTANCE AND YOUR VALUABLE TIME

Annex-3

Addis Ababa University

College of Development studies

Centre for Water and Development

Checklist for Focus Group Discussion

Name of Group Members

1.
2.
3.
4.
5.
6.
7.
8.

1. What are the major opportunities of water supply and the key challenges facing the water supply system in your Condominium housings site as compared with your previous housings water supply? In addition, how do you rate the overall water and sanitation facilities in your Condominium housings site?
2. What do you think that can be done to overcome water supply problems or to improve water supply services in your Condominium housings site?
    - From the side of the condominium unit owners/your own/.
    - From the government/AAWSA perspective.
    - From the side of other institution (NGO, community organization, etc) which participate in water and sewerage provision activities.

Thank you for your valuable cooperation.

Annex-4

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Checklist for Observation

Site Name……

1. The current situation of water source:

- Type of water source

2. Water fetching for domestic purpose with in the housing unit and out of the housing unit:

- Who fetch water?
- How it is collected?
- What type of containers used to fetch water?
- How it is transported?
- How it is stored?

DECLARATION

I declare that this Thesis is my original work and has not been presented for a degree in any other university and that all source materials used for the Thesis have been duly acknowledged.

Student's name: Desalegn Yehouala Zewdie

Signature _____

Place & date of submission: Addis Ababa University, Ethiopia, June, 2013