CHAPTER 1

1.1 INTRODUCTION

Water is essential for life. No living being on planet Earth can survive without it. It is a prerequisite for human health and well being as well as for the preservation of the environment. However, four of every ten people in the world do not have access to even a simple pit latrine; and nearly two in ten have no source of safe drinking water. Every year millions of people, most of them children, die from diseases associated with inadequate water supply, sanitation, and hygiene. Each and every day some 3,900 children die because of dirty water or poor hygiene; diseases transmitted through water or human excrement are the second-leading cause of death among children worldwide, after respiratory diseases. Water scarcity, poor water quality, and inadequate sanitation negatively impact food security, livelihood choices, and educational opportunities for poor families across the world. Water-related natural disasters such as floods, tropical storms and tsunamis exact a heavy toll in human life and suffering. And all too regularly, drought afflicts some of the world's poorest countries, exacerbating hunger and malnutrition (World Health Organisation). The human right to water entitles every one to sufficient, safe, acceptable physical, accessible and affordable water for personal and domestic uses. It is clear that water is fundamental in improving the welfare of communities around the globe. Water and Sanitation is of the primary drivers of public health (WHO, 2000). Water and Sanitation will remain an essential commodity in the human life therefore we endeavour to make it available to all at an affordable price (NWASCO, 2010).

It is then prudent for the general population to support the basic mechanisms to achieve a reliable and safe water supply and sanitation system. However for the Water and Sanitation Hygiene (WSH) Sector, the Human Immune Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) epidemic seriously jeopardises the Millennium Development Goals to halve the proportion of people who are unable to reach or afford safe drinking water. The same applies to the goal set in World Summit on sustainable development in Johannesburg in 2002 to halve the number of people without access to improved sanitation.

Water supply in Zambia is highly uneven. Only 40 percent of rural dwellers have access to safe drinking water, while 90 percent of urban residents have access. Many residents of peri-urban and rural areas have no choice but to use dirty rain water or unclean water from low streams. Some families have tried to dig shallow wells, often near pit latrines, not knowing about the health hazards this may cause. Sanitation-related diseases including cholera and trachoma are the second biggest killer of Zambia's children after malaria (WHO 2004).

The government of Zambia through the Ministry of Local Government and Housing (MLGH) has over the years instituted various legal and institutional reforms and programmes aimed at improving the water supply and sanitation sub-sector. Notable among them is the establishment of Commercial Utility Companies (CUs) to facilitate the provision of clean and safe drinking water and adequate sanitation to communities in urban and peri urban areas. The rural communities are being catered for by the development of the National Rural Water Supply and Sanitation Programme (NRWSSP) whose objective is "to provide sustainable and equitable access to the Government's roadmap for increasing access to safe water supply and proper sanitation to meet basic needs for improved health and poverty alleviation for Zambia's rural population and contribute to the achievement of the Millennium Development Goals (MDGs) for water supply and sanitation.

It is, however, not that simple to address these social problems which have since become imbedded in politics of populism. Unplanned settlements are a source of disasters in urban areas, because providing safe drinking water and proper sanitation through connection of water and sewer networks without re-planning in such areas is extremely difficult.

In conclusion it is important to provide wholesome quality and quantity of water to improve the living conditions of communities just as the theme for the 2010 world water day states clean water for a health world.

1.2 STUDY AREA

Zambia Compound is situated on the southern part of Kafue District and borders with the Kafue River on the western part, Nitrogen Chemicals Factory on the east and is about 1 kilometre from the Great North Road (Figure 1).
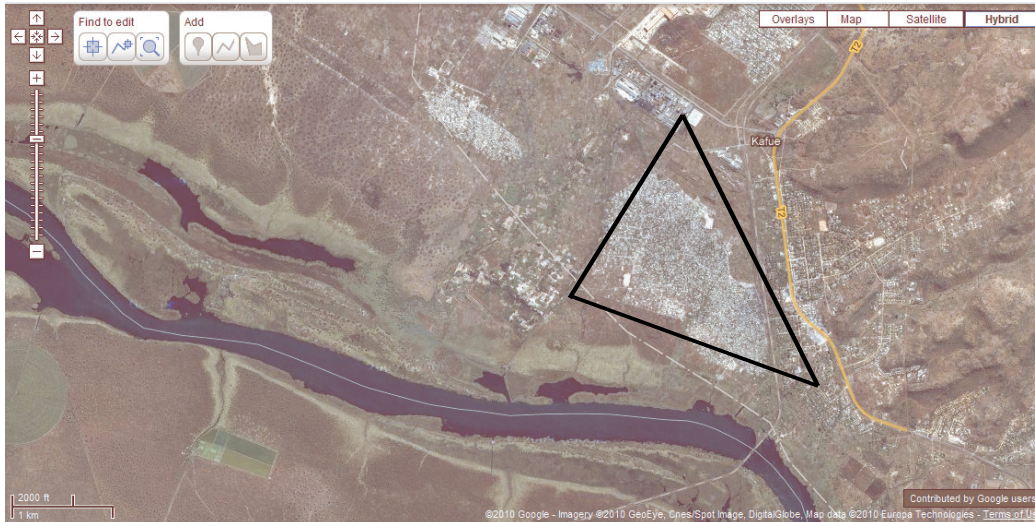
Figure 1: Satellite imagery showing the location of Zambia Compound, in Kafue District (Triangular shape). *(Source: Google Earth)*

Its social economy is characterized by industries such as Nitrogen Chemicals and Bata tannery (which are not operating to expected full capacity), Lee Yeast and Kafue chemicals of Zambia. Others are fish mongering, subsistence farming to mention but a few. The compound is an unplanned settlement and is not serviced with piped water hence there is little access to adequate clean and wholesome supply of water. The compound's sources of water supply are from the Kafue River, about 5 boreholes and about 20 shallow wells. Furthermore it has been observed that for sanitation, people commonly use pit latrines, which are dug between 1 -3 metres deep.

1.3   STATEMENT OF THE PROBLEM

Zambia Compound is an unplanned settlement and is not serviced with piped water; hence there is little access to adequate water supply. The population has increased tremendously (as can be seen by construction of houses towards the Kafue River) against a background of diminishing quality and quantity of water supply. The standard access of domestic water supply has been set at 500m to a water point. Government has tried to reduce the distance covered but has proved difficult because of the settlement patterns. This has complicated the number served by a water point. The rate of access has therefore remained quite low. (Nyambe and Freiberg, 2009) and Zambia National Water Resources Report WWDR3) It is therefore incumbent to study the effects of inadequate supply of water on community health as a case study in Kafue's Zambia compound as partial

fulfilment of the award of this Post Graduate Diploma in Integrated Water Resources Management.

1.4   AIM

The aim is:

- To improve living conditions of people in Zambia Compound.

1.5 RESEARCH OBJECTIVES

These objectives are:

- To assess extent of effects of inadequate clean and wholesome water supply;
- To assess water quality by random sampling of some water point; and
- To raise awareness of residents of Kafue's Zambia Compound on importance inadequate and clean wholesome water supply so as to improve living conditions of people in the area.

CHAPTER 2

2.1 LITERATURE REVIEW

At the turn of the millennium more than 40% of the people of Southern Africa have no access to water for basic needs. As a consequence avoidable water related diseases which prevail in the region result in high mortality rates. The diseases also lower the productivity of large numbers of people and result in reduced human welfare (SADC, 2000). There are five main types of water related infections as follows:

- Water Based - These are transmitted by aquatic organisms such as worms. They penetrate the skin if unclean water is used for cleaning and or bathing;

- Water Washed - Poor personal hygiene resulting from inadequate water availability;

- Waterborne - these are spread by eating or drinking food prepared with contaminated water;

- Water related insects vector spread by insects breed in stagnant water; and

- Diseases caused by defective sanitation - these are direct result of poor sanitation. They may be contracted with contaminated soil which is contaminated by human faeces where no proper disposal of waste exists (Global Health, 2008).

The public health challenges of unsafe water and inadequate sanitation have plagued humanity for centuries, and will continue to do so unless governments make water and sanitation infrastructure improvements one of their first priorities .An assessment on the effects of water and sanitation on linear growth, diarrhea disease and prevalence of parasites was done in a town called Lima in Peru.

Peruvian children with inadequate water supply were found to be shorter and more episodes of diarrhea (Checkley, 2004). The prevalence of intestinal worms (helminth infections) was 54.9% in the urban government school, 63.5% in the rural government school, and 28.4% in the private school. The most common worm was roundworm (Ascaris lumbricoides), followed by whipworm (Trichuris trichiura), tapeworm (Taenia species), and hookworm.The water and sanitary conditions were poorer in government-owned schools than in the private schools and Intestinal worms were more common in

Nigerian children attending government schools than private after examining that the water supply was inadequate in government schools, thus the burden of parasitic infections in children and poor sanitation (Ekpo, Odoemene and Wobo, 2008).

- The number of safe drinking water almost -1- billion lack access to an improved water supply.
- Diarrhoea Diseases – 2 annual death attributed to unsafe sanitation and hygiene;
- Cholera- more than 50 countries report to World Health Organisation; and
- Schtosomiasis – an estimated 240million cases are reported.(Facts and Figures on quality of water (WHO, 2010).

Every 8 seconds, a child dies from a water related disease and 50% of children in developing countries suffer from one or more water related disease. (UN) Four billion cases of diarrhoea are reported per year, 1.8 million deaths over 90% (1.6 million) among them children under five years and repeated episodes of diarrhoea make children more vulnerable to other diseases and malnutrition (UNICEF, 2005).

Women and children continue to walk long distances to and from the sources and carrying water on their heads using jerry cans and saucepans. As a consequence they are prone to experiencing health problems such as headaches, general fatigue and pains in the neck, chest and waist. Furthermore the time spent in long queues to obtain water has reduced time for other activities such as farming and cooking (WaterNet, 2003). Often, girls and women are in charge of collecting water for their villages and homes – sometimes walking extremely long distances to do so.

Traditionally, girls are looked on as people who should do the domestic chores so they will have to join their mothers to walk one or two kilometres or more to fetch water during that time the girls are too tired to really come back home and concentrate on education. Time spent on queuing sometimes makes school children late for school (Times of Zambia, 2005). Fighting at the source of water has been reported. At least eighty people were killed and several others injured in Ban Jadid following recent clashes in Al-Wihda payam in South Darfur State. These clashes were tribal fights which started at a water point between a few people and then grew and became a big fight. Around 82 people were killed while 25 were wounded (SRS, 2010).

In Zambia, 83 % of urban households have access to clean and safe piped water compared to only about 19% of protected dug well of rural households and more than 56 percent of the total population draws their water from unimproved sources which includes unprotected dug well, rivers and dams among others. Dehydration caused by severe diarrhea is a key cause of infant deaths in Zambia. This will not change until government makes a major effort to improve access to clean water and sanitation throughout the country (ZDHS, 2007).

In the last seven years of this decade Zambia has had to endure droughts in the rainy seasons of 2000/01, 2001/02 and 2004/05. The impacts of these droughts have included widespread crop failure loss, outbreaks of human and animal diseases, dislocation of population and destruction of property and infrastructure (Nyambe and Freiberg, 2009).

CHAPTER 3

3.1 METHODS OF STUDY

This chapter gives a description of analytical framework, indicators, data collection and limitation of the study.

3.2 ANALYTICAL FRAMEWORK

The analysis in this study is based on the assumption that use of inadequate clean and wholesome water has effects on the health of a community. Such effects are out breaks of diseases categorized as:

- Water washed;
- Waterborne;
- Water related;
- Insect vector; and
- Those caused by defective sanitation.

Other effects are droughts, which result in less crop production leading to famine and starvation causing malnutrition and stunted growth especially in children. Long distances covered to fetch water and long queues at water points reduce time for other activities and women and children in most cases have fallen victim of rape as they search for this commodity and in the process contract the HIV/AIDS disease.

3.3 INDICATORS

To determine the effects of inadequate safe and clean wholesome water supply on the health of the community in Zambia compound, it is important that we look at the number of indicators that will show us these effects.

Below are the indicators, which have been considered to give us the effects:

- Occurrence of diseases associated with water
- Knowledge of respondents on Quality and Quantity of water
- Quality of water

3.4 DATA COLLECTION

This study drew data from secondary and primary sources.

3.4.1 SECONDARY SOURCE

The initial part of the research involved a search for data from secondary sources that is books, reports and the internet. Secondary sources of data provided a starting point for the research as well as a basis for comparison with what the researcher found in the field. Secondary sources were also consulted as they gave an insight into the areas that had not been researched or that required more research thus helped to determine areas of emphasis for the study.

3.4.2 PRIMARY SOURCES

The second part of the research involved a collection of data from primary sources that is residents of Zambia Compound. Primary sources were undertaken in order to obtain information on the subject, thus adding to the body of knowledge on the subject.

3.3.3 SAMPLING

A total of 60 respondents were interviewed and targeted male respondents above 20 years and female between the ages of 15 – 35 being the childbearing age and mostly involved in household chores which includes drawing water and caretakers for children. This target group was chosen in order to obtain primary information.

Data collection instrument used for soliciting information from target group was questionnaire (Appendix 1). It contained both closed and open-ended questions. Open-ended questions were included as they yielded more detailed information, because the allowed the respondents to express their views freely and fully. Closed ended questions were included to solicit specific categories of responses from respondents. Data was analysed using tables and graphs in Microsoft Excel Software.

3.5 LIMITATION OF THE STUDY

The study had the following limitation:

A lot of people were interviewed so that we could get the required target number of respondents for purposes of this research s:

- Some respondents did not want to give answers to parts of the questionnaire;
- Open ended questions were difficult to answer by respondents;
- Male respondents were not willing to be interviewed; and

- Some owners of shallow wells could not allow us to get water for sampling.

CHAPTER 4

4.1 RESULTS OF THE STUDY

The following were results obtained by administration of questionnaires in Zambia Compound in Kafue District and are interpreted and discussed by using tables and figures.

4.2 KNOWLEDGE ABOUT WATER REQUIRED FOR DAILY USE:

100% of both male and female respondents did not know that they are supposed to use minimum recommended amount of water per day for domestic purposes which is 50l/c/d (lifeline' per capita water consumption) as shown in Table 1 and Figure 2

Table 1: Knowledge about water required for daily use in Zambia Compound - Kafue District

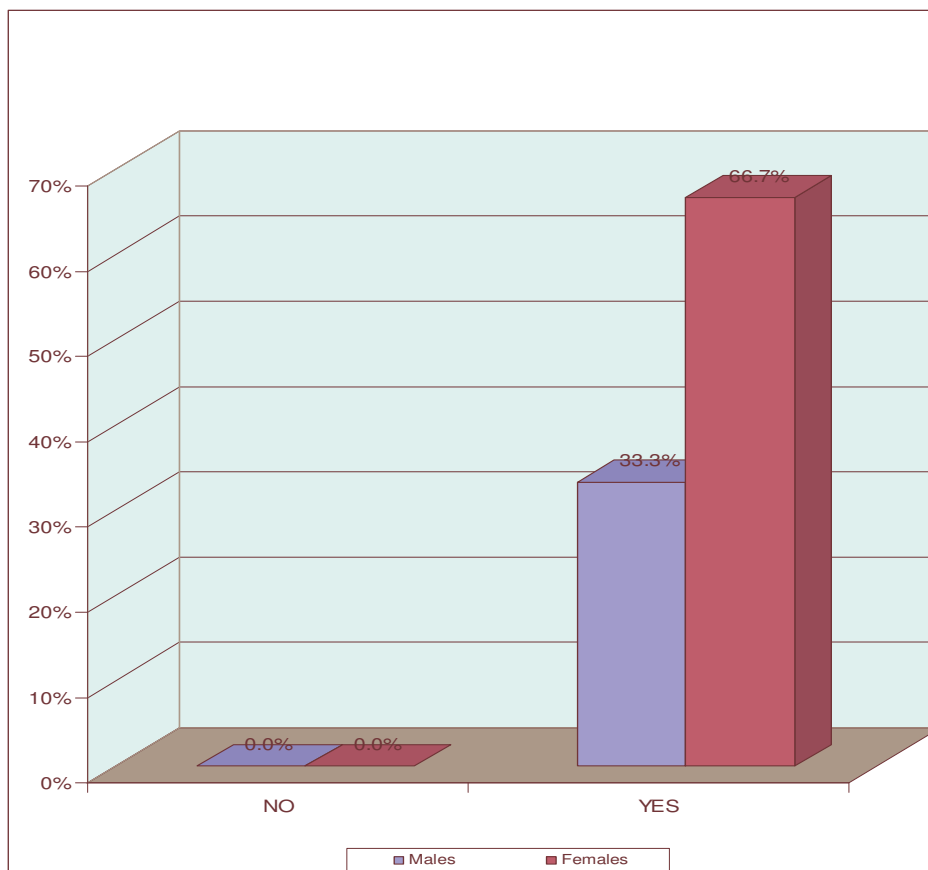|	YES		NO	
	Males	Females	Males	Females
	0	0	20	40
%	100	100	33.3	66.6

Figure 2: Knowledge about water required for daily use in Zambia Compound in Kafue District

4.3 MALES AND FEMALES WITH KNOWLEDGE ABOUT WATER QUALITY

75% males and 62.5% females understood water quality while 25% males and 37.5% females did not understand as shown in table 2 and figure 3.

Table 2: Males and females knowledge about water quality in Zambia Compound in Kafue District

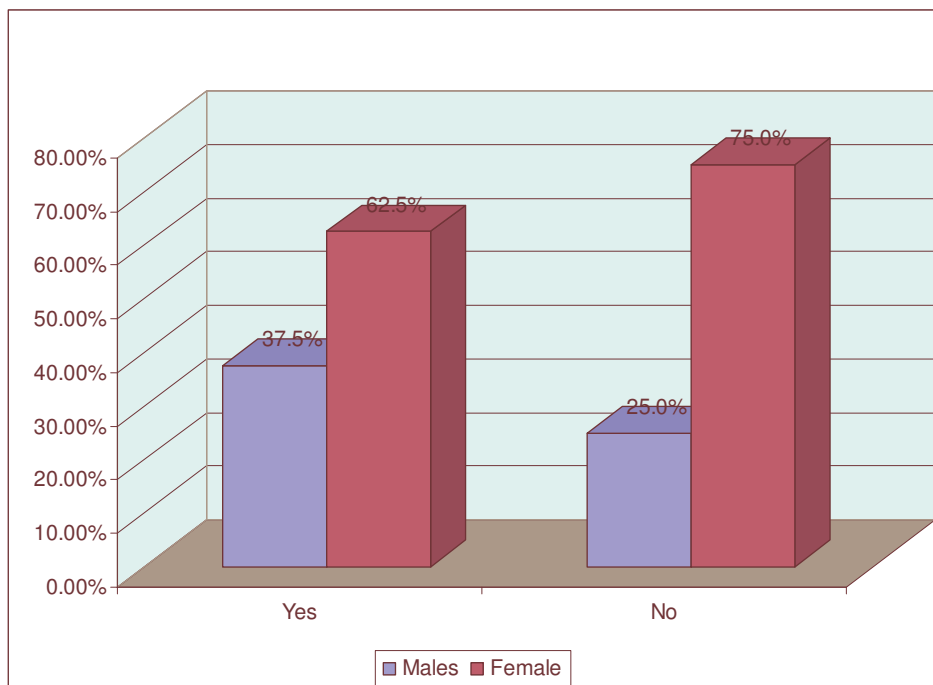|	YES		NO	
	Males	Females	Males	Females
	15	25	5	15
%	37.5	62.5	25	75

Figure 3: Males and females with knowledge on water quality in Zambia Compound in Kafue District

4.4 AWARENESS OF EFFECTS OF INADEQUATE CLEAN WATER SUPPLY

10% males and 0% females did not know the effects of inadequate water supply and 100% females and 90% males knew the effects as shown in Table 3 and figure 3.

Table 3: Males and females awareness of effects of inadequate clean water supply in Zambia Compound in Kafue District

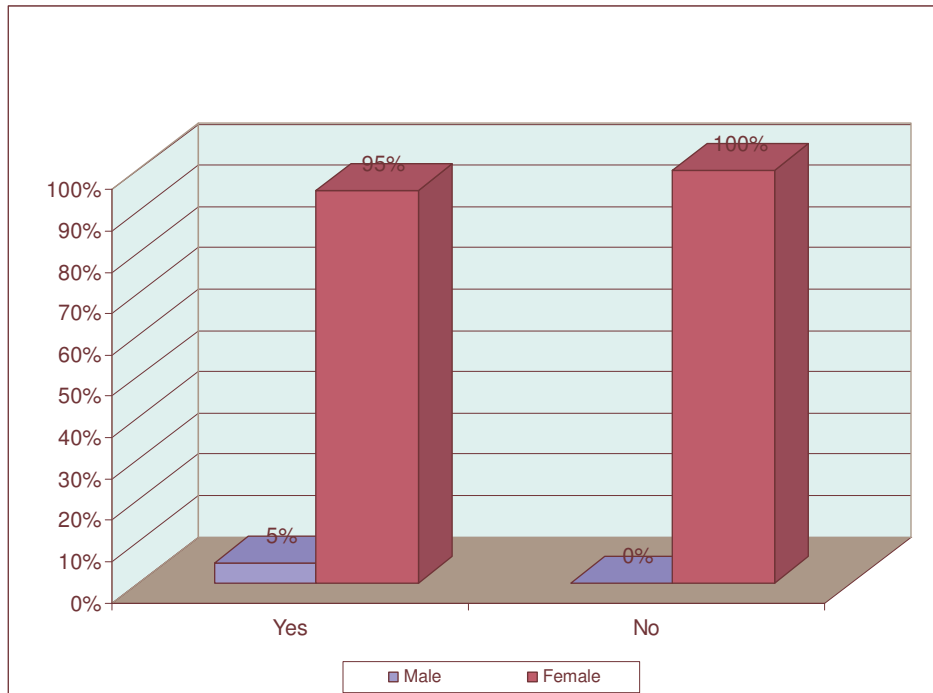|	YES		NO	
	Males	Females	Males	Females
	2	40	18	0
%	10	100	90	0

13

Figure 4: Males and females awareness of effects of inadequate clean water supply in Zambia Compound in Kafue District

4.5 RESPONDENT'S RECOMMENDATION

Both males and females recommended government to provide adequate clean and wholesome water by erecting communal stand taps in Zambia Compound Kafue District

4.6 DISEASES OCCURRENCE

All the sixty - (60) respondents were aware of diseases associated with water quality and quantity such as Cholera, Schtosomiasis, Dysentry and Malaria.

4.7 WATER QUALITY

Water sample results of 8 shallow wells and 1 bore hole revealed that 7 out of 9 water wells had high number of faecal coliform isolated and presence of E coli as shown in Table 4.

Table 4: Results of water samples obtained from selected wells in Zambia Compound in Kafue District

Serial No.	Aerobic plate Count	Faecal Coliforms	Escherichia Coli	Remarks
ZC1	2.6x10	1100	Present	Unsatisfactory
ZC2	1.8x10	150	Present	Unsatisfactory
ZC3	2.1x10	43	Present	Unsatisfactory
ZC4	<3.0x10	93	Present	Unsatisfactory
ZC5	<3.0x10	240	Present	Unsatisfactory
ZC6	3.8x10	1100	Present	Unsatisfactory
ZC7	2.6x10	1100	Present	Unsatisfactory
ZC8	3.7x10	0	Present	Unsatisfactory
ZC9	<3.10	0	Present	Unsatisfactory

According to the Zambian Bureau of Standards, the maximum number of total coliform and E coli allowed in drinking water is 3 and 0 respectively. From the data in Table 3, Zambia Compound in Kafue District is one of the areas that have been affected with problems of use of contaminated water supply.

4.8 DISTRIBUTION OF RESPONDENTS AS TO WHETHER THEY KNOW THAT MALNUTRITION IN CHILDREN CAN BE ASSOCIATED WITH INADEQUATE CLEAN WATER SUPPLY.

50% of males and 12.5% females associated malnutrition to inadequate water supply and 50% males and 87.5 % females did not know as shown in Table 4 and Figure 5.

Table 5: Distribution of respondents as to whether they knew that malnutrition in children could be associated with inadequate clean water supply in Zambia Compound in Kafue District

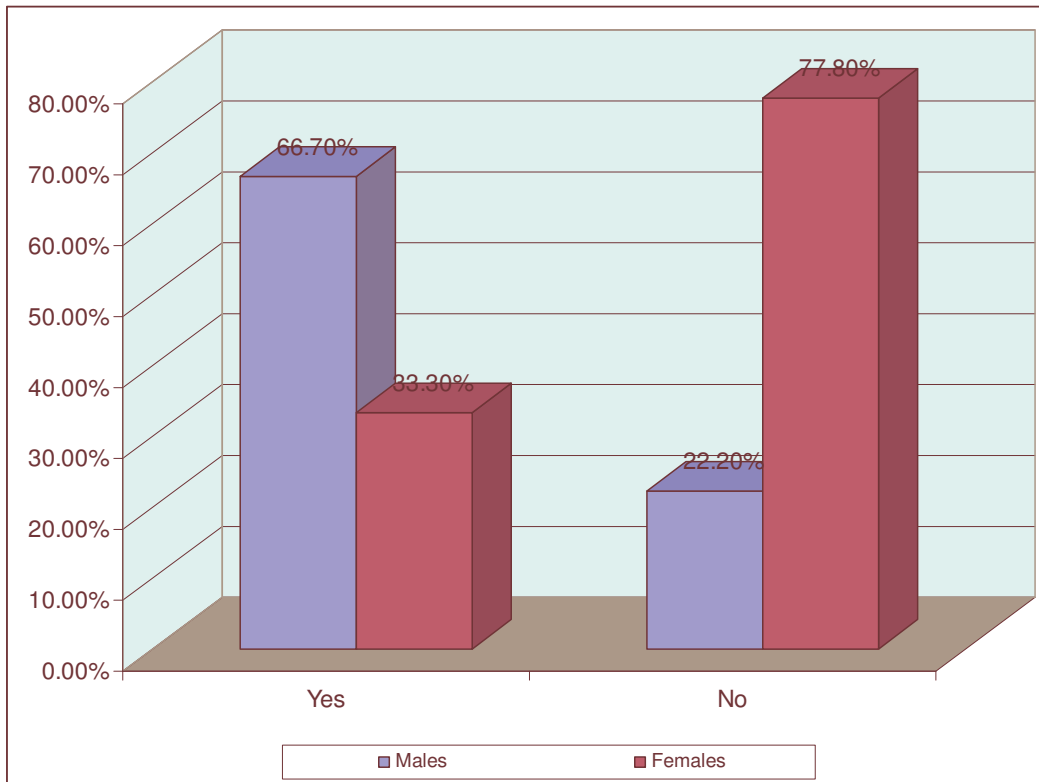|	YES		NO	
	Males	Females	Males	Females
	10	5	10	35
%	50	12.5	50	87.5

Figure 5: Distribution of respondents as to whether they know that malnutrition in children can be associated with inadequate clean water supply in Zambia Compound in Kafue District.

CHAPTER 5

5.1 INTERPRETATION OF RESULTS

In order to understand the effects of inadequate clean water supply on the community health the earlier indicators have been used as a measure, as these are linked to the research objectives and assumptions. The main themes used to determine these were;

- Knowledge about water quality;
- Knowledge about water quantity;
- Awareness of effects of inadequate clean water supply; and
- Disease occurrences.

5.2 KNOWLEDGE ABOUT WATER QUANTITY

All the respondents indicated that they did not know that they are supposed to use a certain recommended amount of minimum water for domestic purposes per day, which is 50l/c/d ('lifeline' per capita water consumption). It is observed that some effects of inadequate clean water supply might not also be known, thus the community will continue to suffer from effects of endemic diseases such as malaria.

5.3 KNOWLEDGE ABOUT WATER QUALITY

25% males and 75% females did not know what was meant by water quality while 37.5% males and 62.5% females understood that only water with a certain quality shall be used. Water sample results showed presence of high of coliform count and E coli than recommended (between 3 and 0 respectively) which meant that the water was contaminated (Table 3).

5.4 AWARENESS OF EFFECTS OF INADEQUATE CLEAN WATER SUPPLY

100% of females and 10% of males were aware of effects of inadequate water supply and 90% of males did not. Since females are mostly involved in daily chores including drawing of water they are the ones that feel the other effects apart from diseases. According to the questions in the questionnaires (distance to a water point and effects of lack of water) most female respondents reported that they experienced a lot of problems because of unavailability of water.

5.5 DISEASE OCCURRENCE

100% of respondents were aware of diseases that are caused by inadequate and unwholesome water. Water samples from shallow wells in which E coli was isolated from and the disease burden recorded from the two Health Centres in the area proves that inadequate water supply has a bearing on disease occurrence in the community.

According to the District Health information Management systems (HIMS) Railway and Nangongwe clinics, which cater for the population of Zambia Compound reports that the disease burden due to inadequate wholesome clean water was as follows in 2009 (Figure 6):

Dysentery. ……………………..277 cases;

Non bloody diarrhoea…………. 2195 cases;

Malaria………………………… 13779 cases; and

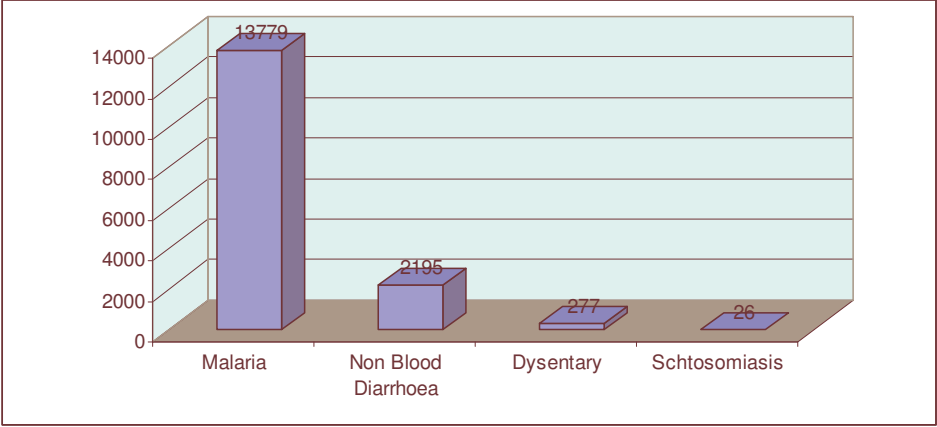Schtosomiasis………………….. 26 cases.

Figure 6: Disease occurrence in Zambia Compound in Kafue District

CHAPTER 6

6.1 CONCLUSION

It has been observed that a number of people in the community are not aware of how much water they are supposed to use for domestic purposes. The minimum estimated urban water demand, which is defined as 'Lifeline' per capita of water consumption has been set at 50litres of clean and safe fresh water per capita per day, distributed as follows:

- Drinking Water…………………………..5 l/c/d;
- Sanitation Services………………………20 l/c/d;
- Bathing………………………………….15 l/c/d;
- Food preparation………………………...10 l/c/d; and
- Total ...………………………………….50 l/c/d.

They are also not knowledgeable about importance of using clean wholesome water. However many understand the effects of inadequate water supply (pains in the neck and waist and time wasted in long queues instead of doing other things) and disease occurrence e.g. Cholera and diarrhoeal diseases.

These findings about water quantity and quality indicate that inadequate water supply and unclean and unwholesome water has an effect on community health in Zambia Compound of Kafue District. This has been deduced from the number of disease occurrence such as malaria (13,779 cases), non bloody diarrhoea (2195 cases), dysentery (277 cases) and schtosomiasis (26 cases).

6.2 RECOMMENDATIONS

The following are recommended:

(i) Health Education campaigns must continually be conducted in the area to   raise awareness on importance of:

- Using clean wholesome water for domestic uses, which is 50l/c/d ('lifeline' per capita water consumption);
- Treating their water by boiling or using liquid chlorine;
- Washing hands with soap after using the toilet and after changing baby's nappies;

- Washing vegetables before eating them;
- Using minimum safe toilet i.e. 3metres deep; and
- Seeking early treatment for diarrhoeal diseases.

(ii) Lobby Ministry of Local Government and Housing through Kafue District Council to construct communal taps within a recommended distance (500m from a household) to avoid residents of this compound walking long distances to water points; and

(iii) Request Lusaka Water and Sewerage Company (LWSC) to install water supply lines for provision of adequate and clean water to Zambia Compound community.

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APPENDIX 1:

Data Collection Questionnaire - Zambia Compound, Kafue District

INTEGRATED WATER RESOUSES MANAGEMENT CENTRE. HOSTED BY THE SCHOOL OF MINES

This research is purely academic in partial fulfilment to the award for the post graduate diploma in Integrated Water Recourses Management of the University of Zambia. The respondent must be assured that information provided in this questionnaire will be used for academic purposes. To ensure confidentiality respondents are advised not to indicate their names.

Back ground information

Indicate your

1. Sex   Male ☐   Female ☐

2. Age ☐

SECTION A

KNOWLEDGE ABOUT WATER QUALITY AND QUANTITY

1. Do you know that you are supposed to use a certain amount of water for domestic use?……………………………………………………………………

2. Do you know how to tell that water is wholesome and clean?
    …………………………………………………………………….......

3. How can u make your own water clean and wholesome?
    …………………………………………………………………..……

4. Do you use clean and wholesome water?
    ………………………………………………………………………….

a. If so, how can you know it is clean?
    ………………………………………………………………………….

SECTION B

AWARENESS OF EFFECTS OF INADEQUATE CLEAN WATER SUPPLY

1. What have you experienced due to inadequate water supply?
   …………………………………………………..................

2. In terms of distance to a water point, what effects have you experiences
   …………………………………………………………………………

3. Do you think luck of unclean water has an effect on your health?
   ………………………………………………………….............

If yes to the above what problems have you experienced?
…………………………………………………………………....

4. What have you done to improve this situation?
   ………………………………………………………………….

5. What can you recommend the government to do improve the situation?
   ………………………………………………………………….

SECTION C
DISEASE OCCURRENCE

1. Are there diseases that are associated with quality and quantity of water?
   …………………………………………………………………
    If yes which ones ……………………………...

2. What other diseases are commonly found in Zambia compound
   ……………………………………………………………….........

3. Can you estimate how many are affected ……………………............

4. Can you associate Malnutrition in children as a result of lack of water?
   …………………………………………………………………

End of Questionnaire