



Assessing the Health Implications of Improved Water Supply in Rural Ghana. The Case of Atwima Mponua District in the Ashanti Region of Ghana.

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Abstract

Improved water supply in rural Ghana gives substantial health benefits. Water is an essential ingredient in all facets of human and economic development. Water has a direct impact on human health and any deterioration in quality affects human wellbeing. Lack of access to safe water is the leading cause of morbidity and mortality globally. Nevertheless, a considerable number of people around the world lack access to safe drinking water. Inevitably the burden of poor access to safe water falls primarily on the poorest of the poor. Until recently, little attention was paid to rural water supply in Ghana. Rural communities traditionally depended on surface and groundwater sources for their water supply needs. The Rural Water Supply & Sanitation Initiative (RWSSI) and the Rural Water and Sanitation Programme (RWSP-IV) with funding from the African Development Bank have significantly improved the water supply quality and access in rural Ghana. The empirical investigation of this study is based on the Atwima Mponua District, a beneficiary of the RWSSI and RWSP-IV programs. The main water related diseases in the district before the provision of improved water supply were malaria, buruli ulcer, worm infestation, diarrhea and bilharzia. Improved water supply has reduced the incidence of water related diseases in the district. However, frequent breakdown of water facilities, collection of water user fees, distance of water facilities to farm and time spent in accessing safe water source hamper total eradication of water related diseases. Government-community collaboration is an effective way of ensuring improved water supply sustainability for lasting benefits.

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List of Abbreviations and Acronyms

CWSA: Community Water and Sanitation Agency

CWSD: Community Water and Sanitation Division

FEP: Food Empowerment Project

GPRS I: Ghana Poverty and Reduction Strategy I

GPRS II: Growth and Poverty Reduction Strategy II

GWSC: Ghana Water and Sewerage Corporation

IDWSSD: Drinking Water Supply and Sanitation Decade

IPCC: Intergovernmental Panel on Climate Change

MDGs: Millennium Development Goals

MWRWH: Ministry of Water Resources Works and Housing

NCWSP: National Community Water and Sanitation Project

RWSP: Rural Water and Sanitation Programme

RWSSI: Rural Water and Sanitation Intervention

UNDESA: United Nations Department of Economic and Social Affairs

UNEP: United Nations Environment Programme

UNESCO: United Nations Educational, Scientific and Cultural Organization

UNFPA: United Nations Population Fund

UNICEF: United Nations International Children's Emergency Fund

UNWWAP: United Nations World Water Assessment Programme

WATSAN: Community Water and Sanitation Committees

WHO: World Health Organization

WRDs: Water Related Diseases

WSSCC: Water Supply and Sanitation Collaborative Council

WWC: World Water Council

Chapter 1

1.1 Introduction

Water is central to all living organisms. It is an essential ingredient for human survival because an adequate water supply is a prerequisite for human and economic development (Biswas, 2005). Water has a direct impact on human health and any deterioration in quality may affect human wellbeing. The global health burden associated with lack of access to safe drinking water is astounding, with an estimated 4000-6000 children dying each day from water related diseases (Moe and Rheingans 2006:1). Further, Schuster-Waller et al (2008) expounds that lack of access to safe water is the leading cause of morbidity and mortality globally.

Judging from this premise, it could be deduced that improving access to safe water will reduce child and maternal mortality, reduce if not eradicate water related diseases, provide women with more time to engage in productive activities, reduce income poverty and enlarge social and economic opportunities (UNFPA 2003). Improved water supply is adjudged the single most cost effective means of reducing water-related death and disease globally (UNEP 2012:98). Notwithstanding, about 1.1 billion people globally lack access to safe drinking water and approximately 2.4 million deaths a year are attributed to unsafe drinking water (Pal 2012). It is projected that “more than 600 million people will still lack access to safe drinking water in 2015” (UNEP 2012:98). Additionally, almost 80 per cent of the world’s population lives in areas with high water security threats. The most affected group covers 3.4 billion people in nearly all developing countries. Water stress and scarcity is likely to be severe in the coming decades due to increased demand coupled with altered precipitation patterns associated with climate change UNEP (2012:115). About 40% of Ghanaians lack access to improved water supply and the situation is more pronounced in rural areas (MWRWH 2010).

After decades of neglect, water has recently arrived on the international political agenda. Various policies are being devised with the aim of improving access to safe water supply. Globally, momentous progress in access to improved drinking water has been made since 1990 (UNEP 2012:115). This is evident in initiatives as the International Drinking Water Supply and

Sanitation Decade (IDWSSD 1981-1990), World Summit on Sustainable Development and the Millennium Development Goals. In most instances, water is declared a universal basic need which everybody is entitled to. According to UNDESA (2010 in UNEP 2012:115), despite these efforts several regions including most of Africa and other rural areas in developing countries, still lack access to improved water sources. Although the Millennium Development Goal drinking water target was met in 2010, important inequality across regions and the rural-urban subdivision exists. UNEP (2012:115) reports that “whereas only 4 per cent of people in urban areas lacked access to improved drinking water in 2010, in rural areas 19 per cent of residents lacked such access”.

Locally, countries have devised strategies to help improve access to safe water. The launch of the National Community Water and Sanitation Project (NCWSP) in Ghana for instance has witnessed an increase in improved water supply coverage especially for rural communities (MWRWH 2010). This together with other reforms in the water sector in Ghana has enhanced the production and utilization of water in the country. The Growth and Poverty Reduction Strategy (GPRS II) of the Republic of Ghana which was linked to all the eight Millennium Development goals had water as a cross cutting element. A section of the strategy has it that “improving access to potable water and sanitation is critical to achieving favorable health outcomes, which in turn facilitate economic growth and sustained poverty reduction” (MWRWH 2007:1).

The framework for these policies decentralized the task of water provision to district assemblies, non-governmental organizations and international agencies. This was with the aim of reducing morbidity and mortality, reducing pre- and post natal risks and preventing vector and water borne diseases. The commitment on the part of government and other agencies has seen the improvement of rural water supply coverage from 41% to 60% at the end of 2009 and this is expected to progress to 78% by 2015 (MWRWH 2007 and WaterAid 2010).

A section of the Ghanaian population still lacks access to improved water supply and is facing the consequences thereof. Nonetheless, the efforts made so far in improving rural water supply have had an impact on the health of the people. According to Esrey (1991:1), research on the health impacts of water indicates that improved water supply reduces health problems. The

research therefore seeks to investigate the extent of rural water supply and how it has affected the incidence of water related diseases. It will further explore the means of making rural water supply accessible and sustainable.

1.2 Research Objectives and Questions

The main objective of this study is to investigate to which degree improved rural water supply has had any effect regarding the health of the people of the Atwima Mponua District. The emphasis will be on the incidence of water related diseases in the district and the general wellbeing of the people. The study will further explore how improved water supply could be made sustainable in the district.

To achieve these objectives, the study will specifically answer these questions.

- To what degree has the water supply improved significantly during the last seven years?
- How accessible is improved water supply to the district?
- What factors account for the present conditions of water supply in the district?
- To what extent has improved rural water supply reduced the incidence of water related diseases in the district?
- How has improved water supply affected the general wellbeing of the people?
- What are the management measures in place to ensure sustainable improved water supply?

1.3 Problem Statement

In as much as water plays an important role in sustaining human health, most rural areas lack access to improved water supply. This important ingredient has not received the needed attention and investment it deserves. As a result, people without access to improved water supply has paid dearly, facing the outbreak of numerous water related diseases which tops the chart for diseases and death tolls in the district.

Water issues have however, recently received much attention at the international, national, organizational, community and individual level. The water sector in Ghana has undergone series of reforms to help the majority of its people, especially those in rural areas to have access to improved water supply (MWRWH 2007:vi).

Following the International Drinking Water and Sanitation Decade the Ghana Government, in line with the agenda for the decade initiated a review of its policies on water provision to keep pace with the changing conditions in the country and on the international scene (CWSA 2012). The National Community Water and Sanitation Programme (NCWSP) was therefore launched in 1994, in step with the Governments decentralization policy. This culminated in the creation of the Community Water and Sanitation Division (CWSD) which is a semi-autonomous unit and the Ghana Water and Sewerage Corporation (GWSC) to manage rural water and sanitation delivery. The CWSA has since been facilitating the implementation the National Community and Sanitation Programme (NCWSP) using the decentralized structures at the district and community levels as prescribed in the Act.

Due to this initiative, there has been an increase in water supply coverage from 41% to 60% between 1999 and 2009 according to 2000 Population and Housing Census (MWRWH, 2010:4). Government commitment to the provision of improved rural water increased in accordance with 2000 UN Millennium declaration (MWRWH 2009). The political dispensation in the country at that time captured its rural water policy in the Growth and Poverty Reduction Strategy (GPRS II) 2006-2009 which laid emphasis on the provision of potable water to contribute the alleviation of rural poverty. The GPRS II was further decentralized to the district assembly level as the main instrument for the implementation of the policy. Mostly implemented on project basis, the policies were incorporated in district action plans (CWSA 2012).

The AtwimaMponua District has been going all length in providing improved rural water supply. In its medium term development plan from 2006-2009 the district had the target of increasing safe water supply from 42.4% in 2005 to 75% by 2009. This was to improve the health of the people because of the high prevalence of water related diseases and morbidity in the district. Water related diseases take almost 50% of all disease occurrences in the district. Due to the inadequately improved water supply coverage in the district at the time, people normally resorted

to unhygienic sources of water from streams and dug outs which posed threats of water related diseases (District Planning Officer, AtwimaMponua: 2012). The Rural Water Supply & Sanitation Initiative (RWSSI) was therefore fashioned in the districts' yearly action plans under the Rural Water and Sanitation Programme (RWSP - IV) with funding from the African Development Bank. The project ran from 2005 till December 2011. Under this initiative, many boreholes and hand dug wells were provided. A preliminary survey in the district revealed that almost all the villages in the district have at least a borehole that served as an alternative and assumingly more preferred source of water to the surface water they were previously using. As a global confirmation, a joint report by the United Nations International Children's Emergency Fund and the World Health Organization (UNICEF; WHO 2012 :1) states inter alia that as of 2010 the target for drinking water has been met. It further explains that since 1990, more than 2 billion people have gained access to improved drinking water sources. That "achievement is a testament to the commitment of Government leaders, public and private sector entities, communities and individuals". They saw the target not as a dream, but as a vital step towards improving health and well-being.

The question therefore is: do people in the district have access to improved water supply? Are the boreholes provided accessible to all community inhabitants? Are there factors that make people still use unsafe sources of water supply? How far has this come in improving the health of the people in terms of reducing and if possible eradicating the incidence of water related diseases? Do women have more time to engage in other productive activities or the time spent collecting water is still the same? What measures are in place to ensure the sustainability of these water facilities? These among others inspire the objective to explore the extent of access to improved water supply and how the current improvement has affected their health.

1.4 Methodology in Brief

To draw from the strengths and minimize the weaknesses of qualitative and quantitative research mixed methods research is sometimes preferred (Johnson and Onwuegbuzie, 2004:14). This study therefore employed both qualitative and quantitative research strategy to appropriately address the various research questions. Structured interviews, semi-structured interviews,

observations and document analysis was used to gather information from local communities, the Atwima Mponua District Assembly, the Atwima Mponua District hospital and other key informants in the local community. The combination of both methods dovetailed the different aspects of the study (Bryman 2008:607).

1.5 Empirical Presentation of Study Area

1.5.1 Location and Size

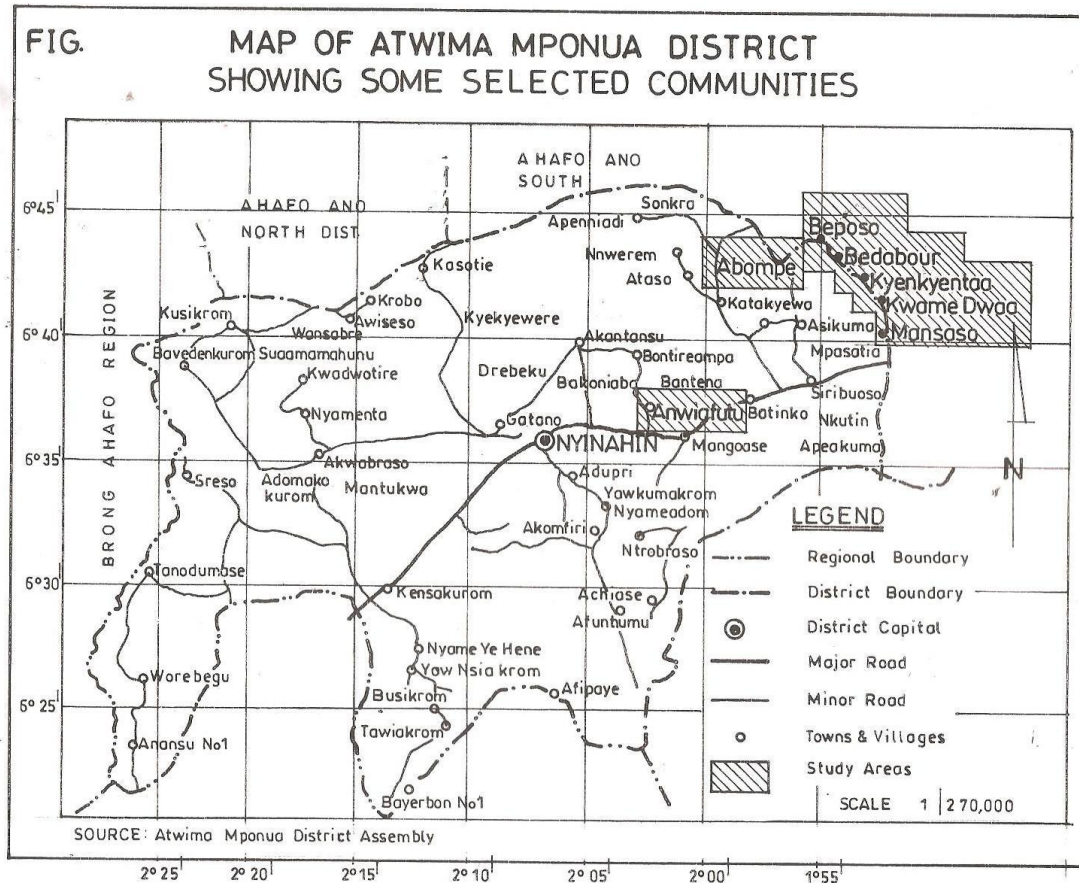
The Atwima Mponua District is located in the south-western part of the Ashanti Region of Ghana covering an area of 894.15 square kilometers. It lies between longitude 2°00'W and 2°32'W and latitude 6°32'N and 6°75'N. The District shares boundary with eight Districts, principally in the South with the Amansie West District, Ahafo Ano South to the north, Atwima Nwabiagya in the East and Bibiani – Anwhiaso – Bekwai District of the Western Region. Nyinahin, the capital is more in the west of the District, about 45km from Kumasi. The location of the District offers it the opportunity to interact with 3 political regions; Brong Ahafo Region, Western Region and Central Region of Ghana.

Figure 1.1: Atwima Mponua District in the Regional Context



Source: ghanadistrict.com

Fig 1.2: Map of the Atwima Mponua District Showing the communities selected for the study.



1.5.2 Climate and Vegetation

The district is marked by double maxima rainfall seasons. The major rainfall period begins from March to July peaking in May. The average annual rainfall for the major season is about 170 centimeters – 185 centimeters per year. The minor rainfall period begins in August tapering off in November with an average minor annual rainfall of 100 centimeters-125 centimeters per year. Mean annual temperatures of 27°C are recorded in August and in March.

The average temperature is about 27°C with variations in mean monthly temperature ranging between 22°C to 30°C throughout the year

1.5.3 Vegetation and Forest Resources

The vegetation is basically of the semi – deciduous type. The flora and fauna is diverse and composed of different species of both economic and ornamental tree species with varying heights and game and wildlife. Forest occurs along the major rivers and streams. There are four (4) forest reserves in the District stocked by such valuable timber species as wawa, sapele, esa, asafena etc. The reserves include the Asanayo, Gyemara, Tano – Offin and the Offin Forest Shelter. The vegetation of the District has been extensively disturbed by human activities depriving the District of valuable tree species and other forest products. There are however on-going programs to replant some of the degraded lands.

1.5.4 Geology and Minerals

The District is underlain by the Birimain and Tarkwaian rocks that are rich in minerals such as gold and bauxite. Gold bearing rocks are found at Ntroboso, Bontomuruso, Anwiafutu, Kyekyewere, Ataso and Aniamoa. Bauxite is found at Nyinahin. Gold prospecting is going on in a number of communities in the District. However, illegal mining activities are very rampant in the District. These illegal miners usually use excavating machines to create large pits that are left uncovered leading to the creation of artificial dams. These dams pose a great danger to the lives of people living in these communities. Their illegal activities have negatively affected the forest vegetation in the District especially communities like Ataso Ntroboso, Bontomuruso, and Anwiafutu thereby rendering their agricultural lands unproductive. The Nyinahin bauxite however remains un-exploited.

It can be expected that exploitation of the minerals in the District will greatly energize the development of the District through job creation, improved household incomes and the much needed revenue in the form of royalties to the District Assembly. However, these illegal mining activities could lead to reduction in food crop production since the youth who are energetic leave farming in the hands of the aged population.

1.5.5 Population Size and Growth Rate

The total population of the District according to the 2010 population and housing census was 119,180 made up of 61,090 males and 58,090 females. The District has a higher population growth rate of 3.6% compared to the Regional rate of 3.4%. The population of Atwima Mponua is scattered in about 323 settlements. The current District density is estimated at 121 persons per square kilometer. The District has a high youthful population which has implications on development issues like education, health, environment, sanitation, security and safety. In Ghana, settlements with population of 5,000 and above are classified as urban. Based on this criterion, only three communities could be classified as urban settlements in the district. The Atwima Mponua District Assembly is therefore dominantly rural as about 85.1% of the people reside in the rural areas, with only about 14.9% staying in the ‘urban’ settlements.

1.5.6 Economy of the District

The Atwima Mponua District is predominantly agrarian like most rural Districts in Ghana. A survey conducted in the district shows that 66% of the population are into agriculture, followed by commerce (20%), industry (11%) and then service (3%).

Table 1.1 Occupational Distributions of the Population.

SECTOR	300 RESPONDENTS	% OF RESPONDENTS
AGRICULTURE	198	66
COMMERCE	62	20
INDUSTRY	31	11
SERVICE	9	3
TOTAL	300	100

Source: Socio-Economic Survey AMDA-DPCU 2009

The results of the socio- economic survey conducted towards the preparation of this medium term development plan show that about 66% of the labour force is engaged in agriculture as compared to about 52% at the National Level (about 61% for Ashanti Region). The commerce sector ranks second in importance to Agriculture with 20% of the labour force engagement 2005, while 11% is engaged in the industrial sector followed by 3% for services. Improvement in

infrastructural facilities such as construction of market centres, extension of electricity and improvements in roads in the district are responsible for more inhabitants venturing into other sectors of the economy such as trading and manufacturing among others. About 60% of household incomes in the district fall outside the National and Rural Incomes. This is an indication that the standard of living is low and poverty is rife in the district. The Socio-Economic survey showed that agriculture is the main source of household income in both the rural communities and urban areas followed by trading, wage employment, remittances and others.

1.5.7 Water Supply in the Atwima Mponua District

The main potable water facilities in the District are hand-dug wells and boreholes. There are 342 boreholes in 262 settlements and 33 Hand-dug wells fitted with hand pumps in 17 settlements. In addition, two towns in the District have pipe borne water. Nyinahin has a small town water system while Mpasatia is served by the Ghana Water Company's Owabi Dam from Nkawie.

Using the National Water Sector Planning thresholds of 1: 300 for a borehole and 1: 150 for a hand-dug well, the District with an estimated population of 143,303 could be said to have potable water coverage of almost 70% (the estimated served population is about 107,550). The remaining population relies on lined and unlined hand-dug wells, ponds, streams and rivers and harvested rain water in the wet months. Unfortunately most of the streams and rivers dry up during the dry season resulting in severe shortage of drinking water. The survey revealed that some of the facilities (pumps) are old and inefficient. The population in some communities has also outstripped the installed capacity. The seemingly potable water coverage is very deceptive since it does not clearly indicate the condition of the facilities or the quantity of potable water available for domestic use and waiting time at the point sources. The underground water level drops considerably during the dry season and negatively impact on potential water available in boreholes in the District. The water yield per minute reduces with an attendant increase in waiting time. Some families as a result revert to polluted sources to save time during this time of the year. All the three Senior High Schools in the District have potable water on the School compound but only one basic school (Anwiafutu DA Primary) has water.

All water facilities in the District are community operated, managed and maintained. Community Water and Sanitation Committees (WATSAN Committees) have been formed in all communities with potable water facilities and are responsible for day-to-day operation of their facilities. The Community Ownership and Management (COM) is however fraught with problems that includes lack of spare parts and area mechanics. Fund mobilization is generally poor. Most WATSANs are ineffective resulting in many broken-down boreholes which have remained unrepaired.

In pursuit of the Millennium Development Goal of the sub-sector, 360 boreholes and 23 hand-dug wells have been constructed under the Rural Water and Sanitation Programme (RWSP - IV) and the Rural Water and Sanitation Intervention (RWSSI) with funding from the African Development Bank. It is expected this will propel the District to achieve the Millennium Development goal for the sector by improving access to potable water. This in a nut shell will reduce the incidence of water related diseases which takes about 50% of the top ten diseases in the district. However, the benefits will not last if communities renege on their commitment during the projects implementation. Rain harvesting as a potable water technology option needs to be considered in the light of the heavy rainfall in the District. Through this method, water could be made directly available for domestic and productive purposes. It also pose the potential of being able to provide improved water supply in the various rural communities without the application of conventional technology (Kahinda et al 2007:1050).

Chapter 2

Literature Review and Theoretical Framework

2.1 Literature Review

2.1.1 Improved Water supply and sustainable Development

According to UNEP (2012), freshwater is critical to human development and integral to the transition to a green economy. UNFPA (2003) also highlights the indispensable role that water plays in all facets of development. Access to safe freshwater is now regarded as a universal human right (United Nations Committee on Economic, Social and Cultural Rights, 2003 in Kundzewicz et al 2007:175). The Millennium Development Goals include the extended access to safe drinking water. Water crisis therefore constitutes a major threat for to global progress towards sustainable development in the new millennium. The situation is even worse in developing countries where the capacity to provide water facilities is hardly available. Pal (2012:25) further emphasizes that water continues to be a vital substance in the sustenance of all life. It is a source of economic and political power with water scarcity being a limiting factor in economic and social development. In its right place, water plays a major role in laying the foundation for economic growth, not only by increasing the assurance of supply, but also by improving water quality and human health (Kahinda et al. 2007:1051). Water scarcity poses a significant and increasing threat to the environment, human health, development, energy security and the global food supply (UNEP 2012:98). The direct link of water to health makes improved water supply a tool for ensuring a healthy population for national development.

One critical concept that is mostly neglected and yet crucial to national development is the time spent by women in collecting water from far places at the expense of productive activities. Sullivan (2001:471) makes it clear that presently, national and regional policy-makers seldom consider the time spent by women in subsistence households. Also, within the structure of the United Nations System of National Accounts, women's housework is never included. Nonetheless, lack of improved water supply most acutely influences the lives of women and children. In developing regions women and children bear most of the burden of domestic water

provision (Sullivan 2001:471). It is unfortunate when as much as 25 percent of women's productive time can be spent in water collection. This clearly has a significant opportunity cost in terms of household human capital entitlements (Sullivan 2001:471). Recent research has confirmed that improved domestic water supply has potential economic benefits. In East Africa, for example, women saw their average water collection distances reduced from 428 to 405 meters (Sijbesma et al 2009:98). It could therefore be presumed that if women get access to improved water supply, the reductions in collection time and energy could be channeled to economic activities. A considerable growth of family incomes is probable in this regard. This goes particularly for poor women with no domestic help.

Water resource availability, or lack of it, is linked to economic and social progress. Development is likely to be influenced by how water resources are managed as regards availability and accessibility to people (Sullivan 2002:1196). Water availability has a direct impact on the self-sufficiency of any economy. Access to clean water is universally accepted as a precondition for economic and social development (Pal 2012:26). Increased access to clean water will reduce social and environmental vulnerability (UNFPA 2003).

Despite the above facts, a considerable number of the world's population lives without sustainable access to improved water supply. The exact proportion of the population without access to improved water supply varies from one finding to the other. Pal (2012:26) has it that "over half the world's population face water scarcity". UNFPA (2003) highlights that one billion people worldwide are denied access to clean water supplies and half of the world's population lacks adequate water purification systems. This might have changed considering the time of the research but the fact still remains that there is a proportion of the world's population with lack of access to improved water supply. According to UNEP (2012:98), although the Millennium Development Goal (MDG) target on water supply was met in 2010, "more than 600 million people will still lack access to safe drinking water in 2015". Water scarcity continues to increase significantly, causing threat to the environment, human health, development, energy security and the global food supply. As it stands, almost a fifth of the world's population lives in areas with physical water scarcity (UNEP 2012:102). According to UNESCO (2009 in UNEP 2012:103), growing population with increasing wealth and consumption levels have tripled global water

withdrawals over the last 50 years. Even though water supply over this period remained relatively constant, demand now exceeds sustainable supply in many places, hence water scarcity around the globe.

Schuster-Wallace (2008:5) attributes lack of improved water supply to lack of adequate capacity and financing. National policies often rely on unsustainable use of water resources and provide inadequate attention to the provision of safe drinking water. Provision of safe water supply is pictured as a non-profitable area of investment as compared to other sectors. This is done without bearing in mind that water has both direct and indirect impact on sustainable development. Providing improved water supply will relieve the world of investments in combating global health burdens. This is because unsafe water supply constitutes a major cause of global health burden (Schuster-Wallace 2008:5). That resource could be invested in other areas thus further promoting development.

Strong economic returns accrue from investments in improving water supply. According to Hutton and Bartram (2008 in Schuster-Wallace 2008:17), epidemiological studies and economic data show the financial benefit of preventative measures for water related diseases. They also indicate the costs to society of not preventing the diseases. Direct and indirect benefits along with tangible and intangible cost savings are also identified. By using these data, policy makers can better prioritize actions by relocating needed resources for the provision of safe water. The development of these data is however a major challenge, as they are costly and there is a lack of technical capacity to perform the studies especially in developing countries (Schuster-Wallace 2008:17). In spite of this challenge, investment in water infrastructure and services can, and should be seen as a catalyst for economic activity and development.

After decades of neglect, water has recently come on the International Political Agenda according to Biswas (2005:229). Significant progress in access to improved drinking water has been made since 1990 although several regions, including most of Africa and other rural areas in developing countries still lack this access (UNEP 2012:115). Increased efforts towards ensuring access to improved water supply could be attributed to the awareness of improved water supply as core to the attainment of sustainable development. Improved water supply is considered the

single most cost-effective means of reducing water-related death and disease globally, ensuring healthy population for national development (UNEP 2012:98).

Among the international policies on providing improved water supply is the International Drinking Water Supply and sanitation Decade (IDWSSD) from 1981 to 1990 (WaterAid 2010:4). The Earth Summits in 1992 and 2002 also saw world leaders committing themselves to a comprehensive program to bring improved water supply to hundreds of millions of people who lacked access. In this direction, the Agenda 21 was adopted. Out of these policies came sub themes under which countries developed customized plans to ensure the provision of water facilities in their respective countries. At the Millennium Summit, world front-runners agreed on the target of halving by 2015 the proportion of people without sustainable access to safe drinking water under the Millennium Development Goals (UNFPA 2003:xiii). This target has since become the core of most government policies perhaps due to its centrality to achieving the remaining Millennium Development Goals and targets. The UN General Assembly also declared access to clean water and sanitation as a human right in July 2010, although it is not yet recognized in many countries (UNEP 2012:115).

UNFPA (2003) analyzes the centrality of water in achieving the Millennium Development Goals. The goal of eradicating extreme poverty and hunger could be succeeded by reduction of water-borne diseases through safe water supply. This would contribute to better health and increased human productivity for livelihood earning opportunities. Increased school attendance would result from better health and nutrition as a result of safe water supplies. This would go a long way to help achieve universal primary education.

Reduced time and economic burden of fetching water for household needs, especially for women and female children would help promote gender equality and empower women. In addition improved water supply provision would reduce health problems of carrying heavy loads of water. Time saved would enable access to education and income generating activities as well as for leisure and rest. Women's empowerment would be expedited through participation in water resource development and management of water supplies. The critical linkage of improved water supply to the achievement of the Millennium Development Goals is summarized in the table below:

Table 2.1: MDG Basic Needs Targets and Critical Linkages to Water

Millennium Development Goal	MDG Target for 2015	Examples of Critical Linkages to Water
Eradicate extreme Poverty	<ul style="list-style-type: none"> ● Reduce by half the proportion of people living on less than a dollar a day ● Reduce by half the proportion of people who suffer from hunger 	<ul style="list-style-type: none"> ● Reduction of water-borne diseases through safe water supply would contribute to better health and increased human productivity for livelihood earning opportunity
Achieve universal primary education	<ul style="list-style-type: none"> ● Ensure that all boys and girls complete a full course of primary schooling 	<ul style="list-style-type: none"> ● Increased school attendance would result from better health and nutrition as a result of safe water supplies.
Promote gender equality and empower women	<ul style="list-style-type: none"> ● Eliminate gender disparity in Primary and secondary education preferably by 2005 and at all levels by 2015 	<ul style="list-style-type: none"> ● Reduced time and economic burden of fetching water for household needs, especially for women and female children. Within reach water supply provision would reduce health problems of carrying heavy loads of water. Time saved would enable access to education and income generating activities as well as for leisure and rest. ● Women's empowerment would be facilitated through participation in water resource development and management of water supplies.

Source: Adapted from UNFPA 2003

It could be realized that improved water supply both directly and indirectly affects national and sustainable development. As Schuster-Wallace (2008:17) rightly puts it, “no other single intervention is more likely to have a significant impact on global poverty than the provision of safe water”. Investment in water infrastructure and services must therefore be seen as a great deal to serve as a catalyst for economic activity and development. Policy makers must better understand the importance for national development as a result of sustainable water management and provision of safe water.

2.1.2 Water Security and Climate Change

Water is an integral element of climate change and the primary medium through which it exhibits its impacts (UNWWAP 2009). The impact of climate change on future society is likely to be pronounced especially in the face of growing water challenges in many regions. Sadoff and Muller (2009:4) emphasize the centrality of water in the climate change process. They argue that water is the primary medium through which climate change will impact people, ecosystems and economies. Globally, the overall impacts of climate change on freshwater resources are projected to be negative (Sadof and Muller 2009:4). Most regions have started showing an overall net negative impact of climate change on water resources and freshwater ecosystems (Kundzewicz et al 2007:175).

There is strong evidence that climate change is altering global and regional hydrologic cycles. The impacts are predicted to be manifested as changing precipitation patterns, retreating glaciers resulting in altered river discharge regimes, and more intense droughts in semi-arid regions (UNEP 2012). Explaining further, UNWWAP (2009:2) states that climate change directly affects the water cycle, and the quantity and quality of water resources. It as well can lower minimum flows in rivers and affect water availability and quality for drinking water.

According to Covich (2009:1), the main impact of climate change on freshwater resources is likely to consist of greatly increased uncertainty in maintaining sufficient local and regional supplies. Additionally, the burden of keeping high-quality water resources to meet demands and sustain natural ecosystem services will be challenging. Higher water temperatures, increased precipitation intensity, and longer periods of low flows exacerbate many forms of water

pollution. The impact will be felt more on ecosystems, human health, water system reliability and operating costs. Pollutants like sediments, nutrients, dissolved organic carbon, pathogens, pesticides, salt, and thermal pollution worsens water insecurity (Kundzewicz et al 2007:175).

Evidence suggests that the volumes of water stored in lakes and rivers are declining because of decreases in long-term average precipitation and runoff and increased rates of evaporation (Covich 2009:1) For countries that have not achieved water security, climate change will make it even harder. Climate variability could further reduce water availability in those areas that already suffer from water stress or water scarcity (Sadof and Muller 2009:4; Tandon 2007:5).

Scientists around the world now agree that the climatic changes occurring internationally are mainly the result of human activity. Although responsibility for the causes of climate change rests primarily with the developed and industrialized nations, the costs of climate change will be borne most directly by the poor (WaterAid 2006). The poor pays the highest price for water systems and are most vulnerable to water crisis. For the poorest families of sub-Saharan Africa, fees to connect to piped water exceed more than a year's income (Tandon 2007:6). What then happens to them when ground and surface water gets depleted or polluted due to climate change?

It is estimated that four billion people (half the planet) will live under conditions of severe water stress because of climate change. The conditions will be especially acute in parts of Africa, the Middle East and Asia. Relative scarcity of water will also deteriorate the water quality in most transition and developing economies (Tandon 2007:6). The UN's Intergovernmental Panel on Climate Change (IPCC 2007 in Tandon 2007) predicts that climate change will have a graver effect on Africa than on any other continent. This is a highly probable fact because improved water supply is already a problem on the continent. There is a projected 20-30percent decrease in water availability in Southern Africa. Consequentially, 40-60 million more people will be exposed to malaria in Africa at a 2⁰c increase in global temperature (WaterAid 2009).

Climate change is also likely to stir up existing water crises and even start new ones. In this regard, Trondalen (2009:3) argues that nations and the international community have to manage changed water-resource conditions. This goes for instances that may fuel old water-related conflicts or even yield new ones. He further explains that ongoing intra-national and

international disputes over water scarcity, water pollution, and water allocation may be intensified by climate change. Africa is particularly threatened with increased risk of conflict over water resources. An extra 155-600 million people could experience additional water stress if temperatures increase by a few degrees (Trondalen 2009:3).

Hydrological variability constitutes the main challenge of maintaining water security. Ensuring water security in the face of climate change needs a sound early adaptation strategy (Sadof and Muller 2009:10). Particularly, countries that lack the infrastructure and institutions to store, manage, distribute and deliver their water resources (Tandon 2007:4). This will deliver immediate benefits to the vulnerable especially those in water scarcity areas in developing countries.

2.1.3 The Linkages of Improved Water Supply to Health

Drinking water constitutes a basic requirement and should be recognized as a great priority (WWC 2012). The daily need for a person is between three and nine liter, depending on the climatic conditions. Each person annually needs between 1 m³ and 3 m³ of highest quality water free of pathogenic organisms, harmful chemicals, low in inorganic salts, and not containing odorous compounds (Zehnder 2002:3). World Health Organization explains this in its Guidelines for Drinking- Water Quality. There is therefore a direct link between the provision of clean water and improved health (Gleick, 1996; Kahinda 2007:1050).

The United Nations Committee on Economic, Cultural and Social Rights, interpreting the provision of the International Covenant on Economic, Social and Cultural Rights in 2002, asserted, ‘...water is fundamental for life and health. The human right to water is indispensable for leading a healthy life in human dignity. It is a pre-requisite to the realization of all other human rights (UNFPA 2003:13). Often, inadequate water supply is pointed out as a factor contributing to poor sanitation which brings about countless water related diseases. Due to this direct link of water to the human body, consuming unclean water affects human health. Productivity and economic well-being are in turn also affected (Mensah 1999:2). For this reason, the goals of improving drinking water supplies are generally geared towards the improvement of

people's well-being and health (Sijbesma et al. 2009:95). A program that increases access to water will reduce disease and thus poverty.

According to Kahinda et al (2007:10050), water-related diseases constitute a cause for concern in both developing and developed countries worldwide. It is estimated that the number of people who die each year from diarrhea, malaria and typhoid and all water-related diseases equals the size of the population of Norway. Nearly 2,900,000 people, mostly children, die from diarrhea alone each year (Rotlier & Ince, 2003 in Sijbesma et al. 2009:98). Additionally, 1.8 million people die every year from diarrheal diseases whilst 3,900 children die every day from water borne diseases (WHO 2004 in WWC 2012). Moreover, the global health burden associated with these conditions is overwhelming, with an estimated 4000-6000 children dying each day from diseases associated with lack of access to safe drinking water (WSSCC 2004 in Moe and Rheingans 2006:41). Doe and Khan (2004:360) further estimate that about 3.4 million deaths yearly in developing countries could be attributed to water related diseases. Drinking water quality provision in many rural areas is substandard. The impact of water-related disease in South Africa is significant with about 43,000 South Africans dying each year from diarrheal disease (Kahinda et al 2007:1050). Enormous cost therefore arises from the annual public and private direct health care.

Parts of the world have made encouraging progress in meeting the improved water target, but serious disparities remain. Lack of access to improved drinking water is still a serious problem in large portions of Asia and Sub-Saharan Africa (Moe and Rheingans 2006:41). Invariably, global health statistics indicate that Africa and South Asia contain the areas most severely affected by waterborne diseases (UNEP 2012:117). High morbidity associated with water related diseases therefore characterizes these areas. Diarrhea, schistosomiasis, trachoma, ascariasis, trichuriasis and hookworm disease are all wholly attributable to unsafe water supply. What is more, Walton and Ivers (2011 in UNEP 2012:117) add that water-related diseases continue to be a public health problem in developing countries lacking access to adequate drinking water. Evidence could be seen from the cholera epidemic in Haiti following the 2010 earthquake.

Unsafe water supply is an important determinant in a number of additional diseases, such as malaria, yellow fever, filariasis, dengue, hepatitis A and hepatitis E, typhoid fever, arsenicosis, fluorosis and legionellosis, some of which present a high disease burden at global level (Prüss-Üstün et al 2004:1321). The impact of unsafe water on human health is severe. Millions of deaths occur each year from water-borne diseases, while water pollution and aquatic ecosystem destruction continues to rise (UNFPA 2003:6). Globally, diarrhea related to inadequate water supply was the second largest contributor to the 2004 global disease burden, claiming more than 70 million lives. At any point in time, over half the world's hospital beds are filled with people suffering from water-related diseases (UNEP 2012:117). Additionally, collection of water from far or near is an onerous task. The continual lifting and carrying of endless containers of water is extremely burdensome and commonly damaging to health. Also, the product conveyed, from whatever source is conveniently available, may be of highly dubious quality (UNFPA 2003:9).

The World Health Organization (WHO) has focused on eradicating about twenty five water related diseases (WHO 2011 in UNEP 2012:117). Following this initiative, there have been some commendable successes in the reduction of onchocerciasis, malaria, schistosomiasis and cholera. Access to clean drinking water is perhaps one of the most important Millennium Development Goals. This is because of its link to human health and the ability of people to carry out productive employment (Steiner and Clos2011). Improving safe water access will therefore improve human health in no small way. For instance, the UNFPA (2003: xii) has it that improving safe water access will mean fewer children will die from water-borne diseases. More women will have time to engage in productive activities, reducing income poverty and enlarging their social and economic opportunities. Thus reductions in child and maternal mortality and improvements in child and maternal health are to be anticipated, as well as reductions in the incidence of malaria and other water-borne diseases. Improved water supply is crucially linked to the achievement of the health targets of the Millennium Development Goals. These linkages are summarized in the table below:

Table 2.2: MDG Health Targets and Critical Linkages to Water

Millennium Development Goals	MDG Target For 2015	Examples of Critical Linkages to Water
Reduce child mortality	<ul style="list-style-type: none"> ● Reduce by two thirds the mortality rate among children under five. 	<ul style="list-style-type: none"> ● Some 60 per cent of all infant mortality is linked to infectious and parasitic diseases, most of them water-related (e.g. diarrhea cholera) that kill 10,000 to 20,000 children each day ● With better survival of children, increased scope of reduction in family size.
Improve Maternal Health	<ul style="list-style-type: none"> ● Reduce by three quarters the maternal mortality ratio 	<ul style="list-style-type: none"> ● Water-related diseases weaken the mother and unborn child; reduced incidence of water-borne diseases and risk of mortality through safe water supplies.
Combat HIV/AIDS, malaria and other diseases	<ul style="list-style-type: none"> ● Halt and begin to reverse the spread of HIV/AIDS ● Halt and begin to reverse the incidence of malaria and other major diseases. 	<ul style="list-style-type: none"> ● Access to safe water is essential for health. Stagnant water supports mosquito population, and increase in temperature associated with climate change expands the area affected by malaria. ● Polluted water shortages, unsanitary living conditions kill 12 million people a year. ● With adequate supplies of safe drinking water and sanitation, the incidence of some illnesses and death could drop by as much as 75 per cent.

Source: UNFPA 2003

Schuster-Wallace et al (2008:9) argue that improved access to clean water would reduce diarrhea and waterborne diseases by 25%. Transition from unimproved to improved sanitation is accompanied by more than a 30% reduction in child mortality. Additionally, simple solutions such as improved water supply can reduce morbidity rates by at least 25%. A study by Esrey et al (1991:609) concludes that improved water supply has a substantial impact on human health. It is critical for curbing water related diseases and its consequences and even crucial to child survival.

2.1.4 Dilemma of Water Privatization

According to Food Empowerment Project (2010), although water is not the rarest element on earth, it is the most precious natural resource because every terrestrial life form; plant, animal and human, depends on it for survival. Rational management of water resources is therefore necessary to ensure availability. Water privatization has recently been viewed as one of the effective ways of water management (Curry 2010). The public sector in most countries until recently was judged to be in the best position to provide water supply. This is because water was labeled public good that addresses basic needs. The private sector was deemed unfit for public service provision, since its main goal is usually to achieve profit rather than enhance social well-being. The role of government in the provision of infrastructure goods and services has however changed dramatically, in both industrialized and developing countries, over the past two decades (Fauconnier 1999).

Water privatization is seen as a relief for financially over-burdened governments in the developing world who are ill-equipped to implement the adequate improvements to their water infrastructures (Curry 2010:113). Even those with adequate financial resources often lack the political will to assume the risk of investing so much in water infrastructure. Privatization therefore allows governments that have failed to provide adequate water to award contracts to corporations, effectively shifting the risk and financial burden. In a nutshell, privatization programs in the water sector have aimed at the improvement of efficiency in the delivery of water services (Fauconnier 1999).

Privatization has yielded positive results in some parts of the world. In the case of Argentina, all categories of the population benefited from improvements in access and coverage, efficiency and quality (Prasad 2006). Guayaquil in Ecuador, Bucharest, several cities in Colombia and Morocco, as well as Côte d'Ivoire and Senegal are also places where water privatization is claimed to have been successful (Wikipedia 2012). Importantly, it was the poor who benefited most from increased access and productivity. In many slum areas for instance, private water sellers and hawking water in jerry cans are often 10 times more expensive than a big water provider via pipelines. Kanbul (2007) further argues that privatization and price increase will reduce water use.

However, it appears privatization in the water sector has not yielded the results that proponents argued for. Kanbul (2007) posits that water privatization in India was not a democratic decision but imposed by the World Bank. There was a subsequent tariff increase in the water supply sector by the World Bank which put the poor at the disadvantage. According to Curry (2010) not only do free market principles ignore the transaction costs, but privatized systems often charge more, leaving those who cannot afford the increase without service. The inherent problems associated with privatization stem from the drive to maximize profits. Corporations cannot remain competitive by following the ideals necessary to eradicate water scarcity: granting all members of the global community access to safe freshwater is often not cost effective (Curry 2010:114). Because corporations are profit driven, they have less concern for the environmental impact of providing water, whether the water is provided in a sustainable manner or the associated costs for third parties.

In places where privatization has been established, it has proven to be another cause of rather than a solution to chronic water shortage problems (FEP 2010). That is, because corporations are more concerned with making money than serving people's and communities' best interests. Consequently, water privatization has led to corruption, lack of corporate accountability, loss of local agency, weakened water quality standards, and steep rate hikes that eliminate poor people's access to water. Prasad (2006:673) further emphasizes that there is an outright rejection of privatization all over the world. This is mainly because of unpopular price hikes and affordability issues, continuing access problems, staff redundancies, and in some cases evidence of exorbitant profits and corruption.

In some cases also, water privatization has been used as conditionality by the World Bank and other Donor Agencies rather than a means of providing access to safe water. Curry (2010:113) explains that water privatization is so deeply entrenched in the water industry that it is growing increasingly difficult for governments to secure loans for water projects from organizations like the World Bank. They are often required to include some sort of private participation. The problem however is once corporations are included in projects they often operate on a concession basis. They require exclusive control of the water supply infrastructure. They then regulate water supply in the best interest of their organization and not community interest. Those who cannot go along with price increase are therefore left un-served. The challenge will therefore not be water supply shortage but lack of adequate means to obtain it. The two sides of privatization therefore brings the dilemma as to whether it is a blessing or otherwise in the field of water supply. But however privatization is viewed, its correct combination with government supervision could ensure rational management of water supply.

2.2.5 Rainwater Harvesting

Rainwater is the source of almost all water resources including surface and ground water. It is known to be an effective way of ensuring improved water access especially for the poor. However, its uneven distribution and availability makes it fairly difficult to be used as a viable improved water source (Siabi et al n.d.). Rainwater harvesting is a technique that has been used since antiquity. It is an option that has been adopted in many areas of the world where conventional water supply systems are non-existent or have failed to meet peoples' needs (Practical Action n.d.). Rainwater harvesting is a term used to cover all those techniques whereby rain is intercepted and used close to where it first reaches the earth (Thomas and Martinson 2007).

According to Siadi et al (n.d) small communities in Ghana are increasingly accepting rainwater harvesting as a technology choice capable of meeting their water needs. If rainwater resources are managed well, emerging phenomenon like flooding and erosion in our communities could be contained. Much water will be intercepted before reaching the ground as runoff. Many regions

including Sub-Saharan Africa, experience highly variable rainfall that is expected to increase with climate change (Boelee et al 2012). That is likely to make rainfall harvesting inconsistent.

Thomas and Martinson (2007) explain that, in rainwater harvesting run-off is channeled from roof-tops into a tank or jar. Water can then be drawn from that store whenever it is needed, hours, days or even months after the last rainfall. Moreover as the jar is generally located immediately next to the building whose roof the rain fell on, rainwater harvesting is used to supply water to that very building, with no need for the water to be carried or piped from somewhere more distant. The essential elements of a Rainwater harvesting system are a suitable roof, a water store and a means of leading run-off flow from the first to the second (Thomas and Martinson 2007). This makes rainwater harvesting a cheap and achievable way of accessing improved water supply.

2.1.6 Making Access to Improved Water Supply Sustainable; the How

One of the most significant failures in the development process has been our inability to match water demand to its supply. A large portion of the world's population lack adequate provision of improved water supply even for domestic use (Sullivan 2001:471). The issue of rights to reliable access to water was made at the 1972 United Nations Conference on the Human Environment and Development at Stockholm. The summit validated the statement that 'all people have the right to have access to drinking water' (UNFPA 2003:12).

However, it appears that lack of adequate capacity and financing, and national policies which often rely on unsustainable use of water resources, prevent sustainable provision of safe water supply (Schuster-Wallace et al 2008:5). The water sector has often suffered severe under-financing. This is a result of lack of internal financial capacity in the poorest of countries and poor political decisions in allocating development aid. A limited cost recovery potential in poverty-stricken regions is also a complicating factor. On the other hand, Pal (2012:26) argues that the progress being is often sabotaged by the fact that once installed water supply systems are poorly maintained and eventually break down. Water supply is consequently disrupted and unreliable. But no matter how the situation is perceived, providing reliable access to improved

water supply is an urgent global challenge. It is pragmatically achievable, politically feasible and ethically important (Schuster-Wallace et al 2008:5).

The task of providing improved water facilities in many countries including Ghana is mostly left in the hands of the central government due to the huge investments are required (Mensah 1999:1). Zehnder et al (2003:13) assert that governments through local authorities have the responsibility of providing sufficient water of highest quality for the basic water requirements to its citizens. Clearly, citizens in developing countries lack the capacity whilst the private sector does not take active part in it except some multinational companies. Because of this, water facilities usually do not last because it fails to include the people that the projects are meant for. The people mostly feel it is even the duty of the government to maintain the water facilities and thus leave them once broken down. It might be an interesting discovery that some people do not have access to improved water supply not because they have not been provided with it but because they failed to maintain it.

According to Schuster-Wallace et al (2008), government capacity needs to be built internally and through South-South collaborations and partnerships, rather than depending on consultants from developed countries. Adopting the policies of the developed world and planting it directly into developing world where improved water access is a problem has proved to be unsuccessful. UNFPA (2003:7) adds that the provision of water management infrastructure and services has commonly been provided by specialists, frequently from more developed countries, with funding from international development organizations. These services however, have time and again proved costly and ineffective in the long-term, driven by top-down approach, and led by outside experts unfamiliar with local needs and conditions. Enormous documentation however exists on the success of community management in rural areas. Evidence could be drawn from the Malawi rural pipe scheme expounded by Kleemeier (2000:929). She explains that twenty six years after completion, the project is still functioning with few hitches since no concept is without flaws.

Research has proved that the required investment costs for adequate water supply in developing countries can be considerably lower, if more appropriate approaches and technologies are

applied (Zehnder et al 2003:14). There is therefore the need for governments, especially in developing countries to incorporate local specialists who are familiar with the environment and who could better bond with beneficiaries. That does not erase the need for North-South collaboration in this direction but governments could have some control instead of leaving everything in the hands of NGOs, donor countries and agencies. In this light, Schuster-Wallace et al (2008), argue for the need for a holistic capacity building that is very flexible encompassing the public sector, academia, community based organizations and the private sector. Another means that could be employed by governments to ensure long term sustainability of water supply facilities is the introduction of user fees. According to Moe and Rheingans (2006:51), the long-term viability of public water services requires user fees and inputs from beneficiaries. These are essential to ensure that services are sufficiently valued, maintenance is provided and overuse of scarce resources avoided. This might take the form of water fees or contributions of time and money to project establishment and running. The main challenge with the application of this concept in developing countries might be how to extract money from already poor people. How possible will it be to take contributions from people who struggle to feed themselves thrice a day, or to take the time of people who spend the whole day on the farm to ensure family food security? There is also the possibility that the monies collected might not be used for the intended purpose. People might be reluctant to make contributions for fear of misappropriation by leaders. According to Olmstead (2003 in Moe and Rheingans 2006:51), these fees have constituted obstacles to the poorest communities and households thus limiting the incentives for providers to extend services to lower income areas. Meanwhile, these are the areas with inadequate or absence of improved water supply. The heart of the problem consequently lies in the dual nature of water as a human right and a scarce natural resource, the management of which requires costs. In as much as water is a human necessity, it cannot be provided in an unlimited fashion (Moe and Rheingans 2006:51).

One key concept that could ensure the sustainability of improved water supply is the empowerment or involvement of the community in the provision and maintenance of water facilities. Community participation according to Sultana (2009:346) has become popular in development practice, especially in the global South and in relation to water resources

management. It has been realized that greater involvement of people in decision making, implementation and evaluation of water management practices increase efficiency and equity in water projects. He further explains that particularly in the rural water sector, there has been a shift from state-led, technocratic water resources management programs to an increase of 'participatory' and 'community-based' water resources management. Moreover, instead of financing and constructing as many schemes as possible, governments and donors should create an environment for communities to take on this role (Kleemeier 2000:929). The responsibilities for providing water for people must be taken at the local level, since higher participation and direct contribution by users ensure sustainability (Zehnder et al 2003:1).

No matter how complicated community participation may seem, it is established that only when communities are involved in decision-making will there be equitable supply of services derived from community empowerment (Rifkin, 1990; Wegelin- Schuringa, 1998; Laverack, 2001; Shortall and Shucksmith, (2001 in Doe and Khan 2004:361). Installations and services for basic water supply in poor countries have proved to be economically feasible. It is sustainable when locally adapted technologies are being implemented together with the participation of all stakeholders and under the supervision of local authorities (Zehnder et al 2003:14). Seemingly, by equipping local communities with simple technologies, problems with improved water supply could be fixed on frequent basis. Also, good management and handling practices could go a long way to ensure sustainability. There is the crucial need therefore, to include beneficiaries in all phases of improved water supply projects. For instance, trained community members who are present at a borehole installation could fix it when a fault develops without having to call for external help which normally delays. It is a common phenomenon to find numerous boreholes abandoned. Not because they are broken beyond repairs, but due to minor faults that the community could have fixed if given the necessary skills. In such instances, people go to unsafe sources of water, not because of the absence of improved water facilities but the absence of sustainability measures.

Recognizing the importance of community participation, world leaders at the Earth summits in 1992 and 2002 adopted community management of services as a guiding principle of Agenda

21. This is backed by measures to strengthen local institutions in implementing basic services programs (Doe and Khan 2004:361). Involving beneficiaries gives lower costs, better targeting of people's needs, incorporate local knowledge and ensures that benefits are equally distributed. It further creates grassroots capacity to undertake other development projects and to maintain benefits particularly in the case of physical infrastructure (Kleemeir 2000:930). Strengthening of local institutions and decentralization are mostly related to bringing power and responsibility down to the community.

There are also instances where community initiatives or social capital alone cannot provide the resources needed whilst the government cannot also be at the grassroots to maintain the facilities after it has been provided. That brings about the concept of synergy. Synergy is a catalyst for development. Figuring out how such public-private cooperation might flourish more widely should be a priority for those interested in development (Evans 1996:1119). Explaining further, Evans (1996:1123) posits that since public agents and citizens have sufficiently different kinds of inputs that are equally necessary, they can produce more efficiently by combining their efforts than by either producing everything privately or everything publicly. He also highlights that the idea of synergy implies that civic engagement strengthens state institutions and effective state institutions also provide a favorable atmosphere for civic engagement to thrive. But as to how this will be made possible, there have been several views. Lam (1996 cited in Evans 1996:1035) maintains that 'developmental success depends on the interaction of highly bureaucratized government agencies and self-organized local communities'. This is a blunt view on the fact that government-society synergy is at the heart of the development process. Patrick Heller (cited in Evans 1996:1035) also validates the effectiveness of mutually reinforcing state-society ties. Estrom (cited in Evans 1996:1036) in her own way accepts this concept by emphasizing 'coproduction' as essential to development. All these views however could be broadly categorized into two contrasting conceptualizations; complementarity and embeddedness. These concepts present different forms of synergy but turn out to be mutually supportive.

2.1.6.1 Complementarity

According to Evans (1996:1120) complementarity is a conventional way of conceptualizing mutually supportive relations between public and private actors. It thrives on a healthy relationship between the public and private sphere. Here, civic engagement is enriched by the provision of public goods but easily threatened if public agencies become more intimately involved in community affairs (Evans 1996:1035-36). It therefore emphasizes a clear cut division of labor based on the contrasting properties of public and private institutions. Government therefore delivers certain distinct collective goods which complements the inputs provided by the private sector (Evans 1996:1120). Putting what these two sectors bring out together generates more output than what each of them could have done on their own.

In the provision of improved water supply for instance, water facilities could be complementarily produced. The government provides the expertise and capital to make the project possible. The communities on the other hand guide the government as to where the project should be located as well as its sustainable management. After its implementation, the community decides how and when community members should get access to the improved water facility and how it should be maintained. The government however follows up from a distance. A new dimension of complementarity is also possible when social capital is included in the process of production (Evans 1996:1120). This is clearly explained by Nugent (1993, cited in Evans 1996:1120) that effective states deliver a rule-governed environment which strengthens and increases efficiency of local organizations and institutions. Through this process, individuals' confidence increase and they are made more capable of contributing in the development process. The state therefore provides the necessary atmosphere but the public agencies are not directly linked to societal actors. This to some extent gives the people the liberty to operate and make things that concerns them. This however does not mean that with complementarity government provides inputs that is allowed to and leaves it to citizens to do the rest. Complementarity supports day to day intervention between public officials and communities ensuring that things are done effectively (Evans 1996:1121). However, there are cases where direct involvement of the government helps to a degree and this brings us to embeddedness.

2.1.6.2 Embeddedness

Embeddedness explains the complexity of the institutional forms that are associated with the day to day public private interactions and the norms that could build around them (Evans 1996:1121). It also questions the assumptions of distinct public and private spheres and the supposedly 'hand off' relations between the state and self-organized communities. Embeddedness conceptualizes the direct involvement of public officials as a key component of getting citizen efforts organized and sustaining citizen involvements (Evans 1996:1123). Perhaps Ostroms' idea of coproduction might imply the more radical embeddedness as suggested by Evans (1996:1036). With coproduction, the public and private actors are enmeshed together in the process of development. Here, there are ties that connect citizens and public officials across the public and private sector divide. According to Ostrom (1996:1073), in coproduction, the inputs necessary in the development process are contributed by individuals who are not in the same organization. Coproduction therefore implies that citizens can play an active role in producing public goods and services of consequence to them. Facilities or services are jointly produced through government-community efforts as there is an intimate entanglement of public agents and engaged citizens. Improved water facilities could therefore be co-financed by governments and communities. In the same way government can intervene as to the day to day management and disbursement of water. The challenge of this concept in developing countries might however be the possibility of poor communities being able to provide the capital needed.

But even in this concept, complementarity is hardly absent. Evans (1996:1123) explains that in the coproduction model, complementarity provides a basis for productive interaction. Without embeddedness however, the potential for mutual gain is hard to realize. The best way therefore to understand synergy is as a set of public-community relations built around the interaction of complementarity and embeddedness as pointed out by Evans (1996).

2.1.7 Policies and Efforts in Improving Rural Water Supply in Ghana

The first public water supply system in Ghana dates back to the then Gold Coast in Accra just before World War I. Extensions were made exclusively to urban areas like the colonial capital of Cape Coast, Winneba and Kumasi in the 1920s (MWRWH 2002:15). Rural water supply surfaced in 1948. There was the establishment of the Department of Rural Water Development to engage in the development and management of rural water supply through the drilling of bore holes and construction of wells for rural communities (MWRWH 2002:15). According to the Community Water and Sanitation Agency (CWSA 2012), much attention was not paid to rural water supply especially from 1965 to 1985. For instance, it was assessed that within this period only 2.2 million (28%) of the rural population had access to improved water as against urban coverage of over 60%.

According to Gyau-Boakye (2001), rural communities have traditionally depended on surface and groundwater sources for their water supply needs. The surface water sources include dug-wells, ponds, dugouts, impoundments from dams, ephemeral streams and rainwater harvesting from roofs. Groundwater supplies to the rural communities are acquired from hand-dug wells with or without hand pumps and springs. Most of these sources are not without problems. They are usually heavily polluted and are the main causes of waterborne diseases so common in the rural communities.

The period from 1981 to 1990 was declared by The United Nations General Assembly as the International Drinking Water and Sanitation Decade. By this, nations were expected to have made significant improvement in water and sanitation facilities provision to their populace at the end of the decade. In her quest to meet international standards and improve the lives of its citizens, Ghana has since the mid 1990'S, been implementing a series of reforms in the water sector. These reforms have culminated in the institutional re-alignment of key institutions in the sector (MWRWH 2009). The National Community Water and Sanitation Programme (NCWSP) was launched in 1994, to fast-track the rural water supply delivery (CWSA 2012). This was followed by the subsequent establishment by an Act of Parliament, Act 564 in December 1998, the Community Water and Sanitation Agency. Its mandate is to facilitate the provision of safe

drinking water and related sanitation services to rural communities and small towns in Ghana. There was also the creation of the Water Resources Commission, Water Directorate and an Environmental Health and Sanitation Directorate, as well as the formation of the Coalition of NGOs in Water and Sanitation (MWRWH 2009:5). All these have tremendously promoted and facilitated coordination in the sector.

The Ministry of Water Resources, Works and Housing (MWRWH 2010) has it that there has been an increase in the coverage of water supply, especially for rural communities and small towns since the launch of the National Community Water and Sanitation Project (NCWSP) in 1994. This assertion to some extent appears questionable since not all areas experienced increase in water coverage. However, significant improvements are evident in some parts of the country.

The advent of the Millennium Development goals (MDGs) increased government's commitment to the provision of improved water supply with endorsements of various water principles. Among these is improving access to safe water supply and sanitation to reduce the proportion of population without access to basic water supply and sanitation by 50% by 2015 and 75% by 2025 (MWRWH 2007:7). Consistent with this, The Growth and Poverty Reduction Strategy (GPRS II) for the period 2006-2009 was formulated which followed the initial Ghana Poverty and Reduction Strategy (GPRS I) launched in 2003. The provision of water is a cross cutting element in both the GPRS II and GPRS I. The GPRS II emphasizes "improving access to potable water and sanitation is critical to achieving favorable health outcomes, which in turn facilitate economic growth and sustained poverty reduction". The National Water Policy, was also approved in 2007 with the aim 'achieving sustainable development, management and use of Ghana's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations' (MWRWH 2009:25).

As at the end of 2009, rural and small town water coverage, based on CWSA standard measurement criteria and definitions, stood at 58.97% from 40%. This was a significant rise from 40% in 2000 and 57.14% in 2008. But it leaves 41.3% of rural and small town dwellers without access to safe water, while it falls short of CWSA's expected coverage of 60% by end of 2009 (MWRWH 2009). Below is the regional water coverage trend of Ghana from 2006-2009.

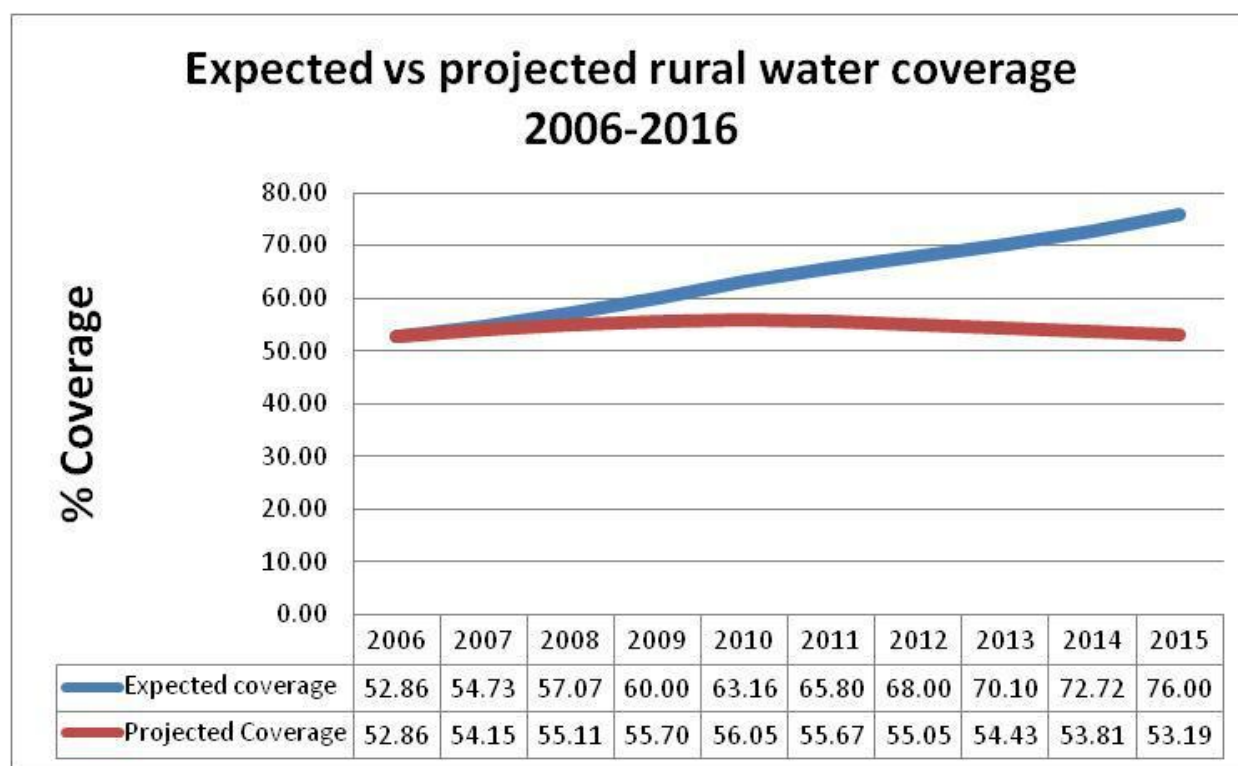
Table 2.3: Regional coverage trends 2006 to 2009

Region	Percentage Coverage			
	2006	2007	2008	2009
Ashanti	63.06	62.82	72.95	72.14
BrongAhafo	52.00	54.44	53.51	53.61
Central	63.06	48.87	44.35	45.10
Eastern	52.00	49.89	58.88	58.56
Greater Accra	50.96	57.23	59.03	59.20
Northern	58.13	59.53	57.97	60.11
Upper East	51.27	52.50	52.24	59.19
Upper West	67.20	78.24	76.76	76.34
Volta	50.99	50.81	54.26	62.63
Western	41.53	40.93	41.27	44.20
Total	52.86	54.86	57.14	58.97

Source: MWRWH 2009

This consistent increase in water coverage is very encouraging. It is expected that if the current trend of rural water supply is maintained, Ghana can achieve over 75% coverage by 2015.

Figure 2.1: Expected vs. projected coverage for rural water supply



Source: MWRWH 2009

Among the decentralized projects of the Community water and sanitation agency is the Rural Water Supply and Sanitation Initiative (RWSSI) funded by the African Development Bank (AfDB). The aim of this initiative was to improve water and sanitation in selected communities in six (6) districts in the Ashanti Region (MWRWH 2009:54). The project ran from 2005 to June 2011. It involved the construction of two Small Town Piped Systems, 1,406 boreholes (plus 300 additional boreholes as a result of savings made on the project) and 16 hand-dug wells in 818 communities. The target Districts are Asante Akim South, Atwima Nwabiagya, Atwima Mponua, Sekyere South, Kwabre East and Kwabre West. The study district, Atwiman Mponua was privileged to be part of the beneficiary districts as have been stated above. According to a preliminary interview with the District Planning Officer of the district, almost all the communities in the district have boreholes of hand dug wells. This means the district can boast of a wide coverage of improved water supply.

2.2 Theoretical Framework

The indispensable role of water in all facets of life has been well established (UNFPA 2003; Pal 2012:25; Kahinda et al. 2007:1051). Water has therefore been declared a universal basic right evident in various international agreements and national policies (UNFPA 2003; WaterAid 2010). It appears that despite these efforts a considerable number of people lack access to improved water supply and the figures are even more overwhelming in poor and developing countries.

Evidently, most theoretical findings confirm that almost all those who lack access to improved water are the poor or those with low capacity to produce this basic right. Moe and Rheingans (2006:51) emphatically state that the global burden of poor access to safe water falls primarily on the poorest of the poor. This confirms the 47% improved water access in low income countries as compared to 98% in high income countries (UNICEF et al 2004 in Moe and Rheingans 2006:51). Another theoretical finding that explains lack of improved water access as stated by Schuster-Wallace et al (2008) is lack of adequate capacity and financing, and ineffective national policies which either rely on unsustainable use of water resources or under invest in the water sector. Against this back drop, the study assumes that ineffective government policies and

inadequate capacity resulting from poverty or lack of education is the main cause of unsafe water usage.

Many academic findings single out human health as one of the concepts directly linked to water availability. The United Nations Committee on Economic, Cultural and Social Rights, explaining the provision of the International Covenant on Economic, Social and Cultural Rights, stated categorically that ‘...water is fundamental for life and health. The human right to water is indispensable for leading a healthy life in human dignity. It is a pre-requisite to the realization of all other human rights’ (in UNFPA 2003:13).

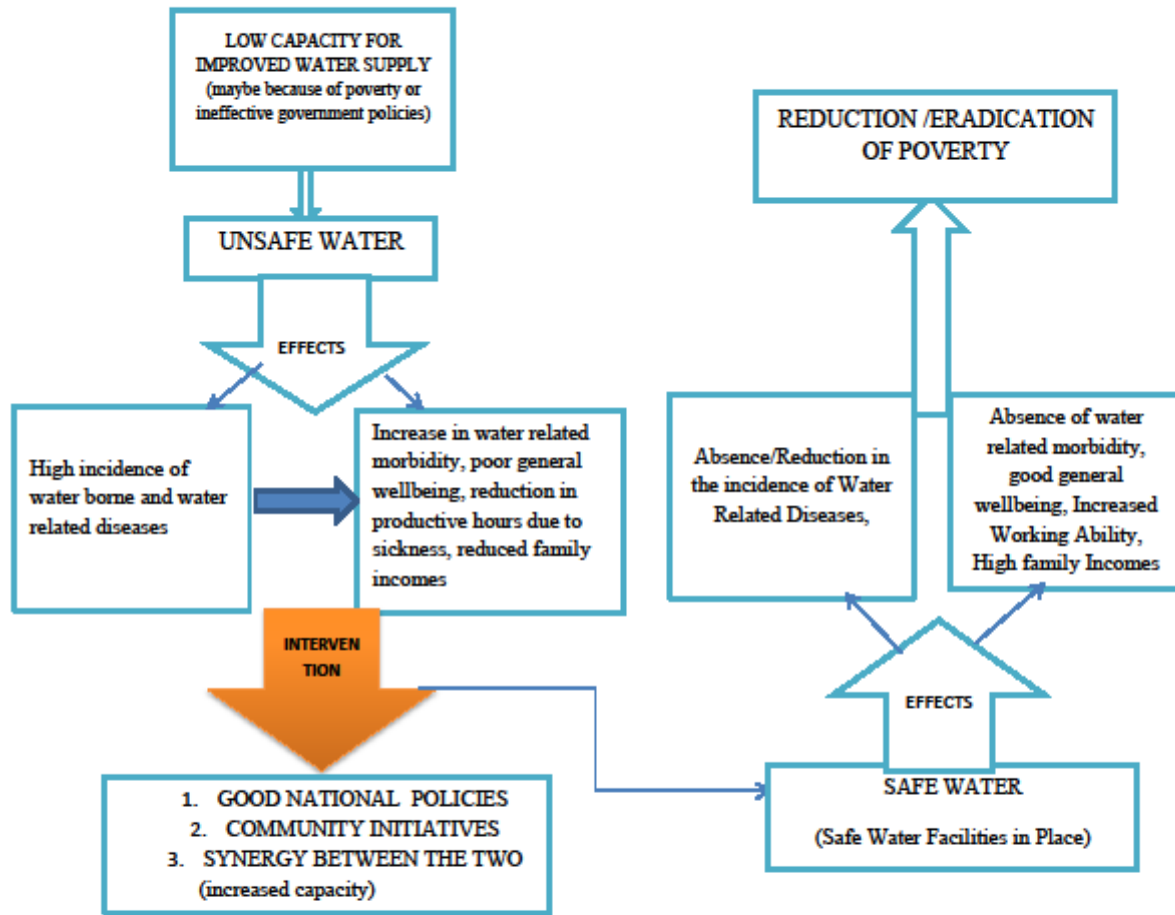
Water related diseases resulting from the use of unsafe water therefore constitute a great percentage of the global health burden (Moe and Rheingans 2006; UNFPA 2003, Schuster-Wallace et al (2008). The evidence is glaring. An estimated 4000–6000 children die each day worldwide from diseases associated with lack of access to safe drinking water, diseases resulting from poor water access accounts for more than 10% of global illness burden, and water-related diseases constitute a major obstacle to the achievement of a healthy population in most developing countries. A sick population has the implication of reduced productive hours because sickness reduces general wellbeing for decent standard of living and reduces household income. Child and maternal mortality increases with most children dying before their fifth birthday and pregnant women losing their babies or their lives all due to lack of access to improved water sources.

Most existing literature approves that good government policies, community initiatives and a synergy between the two could go a long way to help improve access to safe water supply (Schuster-Wallace et al 2008:5; Mensah 1999:1; Sultana 2008:346; Doe and Khan 2004:361 Kleemeir 2000:929 & Evans 1996:1035). Governments are mostly responsible for the provision of water infrastructure as well as a congenial atmosphere for community initiative. Since the community is most directly in contact with the problem, they are as a rule seen as the most appropriate people to provide solutions to what they see to be the problem. This may include bringing out initiatives to provide water facilities as well as managing existing ones. There are situations where community initiatives or social capital alone cannot provide the resources needed whilst the government cannot also be at the grassroots to maintain the facilities

after it has been provided. It therefore becomes efficient for the government and the community to come together.

With improved water supply in place, water related diseases and health burden is likely to reduce by a high percentage, water related mortality will reduce, productivity hours will increase, family income is likely to rise and all this will head towards improved standard of living and thus national development (UNFPA 2003; Moe and Rheingans 2006). As Schuster-Wallace et al (2008:10) emphasizes, “the provision of water is one of the key mechanisms to break the cycle of poverty”.

Fig 2 Theoretical Application



This is a figurative presentation of the Theoretical Framework adapted from the literature review.

Source: Author

2.3 Definition of Terminologies

Community participation is a term used to describe the condition where local communities are empowered to take part in the decision making, installation and management of water facilities.

Health: The most outstanding definition of health is the one by the World Health Organization in 1946; a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO 1946). Throughout this paper, health will be taken to mean a good general condition of body and mind free from water related diseases.

Improved Water: increase in both quality and quantity of water supply devoid of any contaminants.

Rural: The Ghana Statistical Service defines settlements with population below 5,000 as rural. This research therefore takes rural areas to mean all communities with population below 5000.

Sustainability is used to mean the uninterrupted access of improved water supply to the rural populace. Thus after the installation of water facilities, measures must be put in place to ensure their proper functioning over a considerably long period of time.

Synergy: Evans (1996) explains synergy as the situation where public agents and citizens sufficiently put in different kinds of inputs necessary to produce more efficiently by combining their efforts than by either producing everything privately or everything publicly. Synergy will be used in this paper to mean the combined efforts of government and communities to ensure the availability and sustainability of improved water supply.

Chapter 3: Methodology

The research is largely based on the assessment of the health implications of improved rural water supply in Ghana. This involves an investigation of improved water supply coverage in terms of ready access and absence of factors that push people to unsafe water sources. Based on this, the health related improvements were delved into, particularly focusing on the incidence of malaria, diarrhea, bilharzias, worm infestation and buruli ulcers among others. Improved water supply and its health benefits cannot be sustained without proper delivery and management of water facilities. Factors to help make improved rural water supply sustainable was therefore explored. The roles of the government and community as well as peoples' perception of who should provide and maintain improved water facilities were investigated. It is theoretically established that improved water supply have positive impact on health (Esrey (1991:1). However, to empirically assess the impact of improved water supply on health in rural Ghana, a case study research design and mixed methods research strategy were used to explore the Atwima Mponua District. This helped provide an in-depth knowledge of the concept under review. The chapter is structured in three sections. Section one discusses the research design and the research strategy. The subsequent sections highlight methods used for the study. The final section presents the ethical issues in the field and limitations of the research.

3.1 Research Design: Case Study

According to Trocim (2002), research design provides the glue that holds the research project together. It is used to structure the research, to show how all of the major parts of the research project; the samples, measures, treatments or programs, and methods of assignment work together to try towards addressing the central research questions.

The case study research design entails the detailed analysis of a single case (Bryman 2008:52). It is concerned with bringing out the complexity and uniqueness of a particular case (Stake 1995 in Bryman 2008:52). By critically analyzing the components of a particular case, detailed information will be available to confirm or otherwise what the researcher sought to investigate. Considering the fact that this research seeks to assess the relationship between improved rural

water supply and health, it was expedient to employ a single case for the thorough search. The Atwima Mponua District was therefore the unit of analysis for districts in Ghana that are undertaking pragmatic measures to ensure rural water supply. The findings will present the basis for generalization for districts undertaking similar projects and an example for districts without such projects to follow. Although the case study design is normally associated with qualitative research strategy, Bryman (2008:53) explains that it is suitable for the employment of mixed methods.

3.2 Research Strategy

A research strategy denotes the general orientation to the conduct of a particular study (Bryman 2008:22). The choice of research strategy is essentially based on epistemological and ontological considerations. Epistemological issues concern the question of what should be considered as acceptable knowledge. Ontological issues have to do with whether social entities should be considered objective entities or whether they should be considered social constructions built from the activities of social actors (Bryman 2008:18). Epistemological considerations hinges around positivism and interpretivism. Some people insist on the application of the methods of the natural sciences to the study of social reality (positivists) whilst others share the ideology that the subject matter of social science is fundamentally different from that of the natural sciences and such should be treated differently (interpretivists).

Objectivism and constructivism are the two sides of the ontological perspective. Objectivism embraces the assertion that social phenomenon and their meanings have an existence that is independent of social actors, a concept related to the positivist side of the epistemological perspective. Constructivism however asserts that phenomena and their meanings are constantly being shaped by social actors and this relates to the interpretivism side of the epistemological perspective (Bryman 2008:19). Qualitative research is linked to interpretivism and constructivism. Quantitative research could however be said to be connected to the positivist and objectivism perspective since it is biased towards the methods used in the natural sciences. A mixed methods approach therefore embraces all the aspects of epistemological and ontological

perspectives. Though this appears quite complex and contradicting, it provides completeness to research. This research therefore adopted mixed research strategy.

3.2.1 Mixed Methods Research: Combining Qualitative and Quantitative Research

Mixed research is basically a research that combines qualitative and quantitative research strategies (Bryman 2008). Johnson et al (2004:14) posits that mixed methods research is becoming increasingly articulated, attached to research practice, and recognized as the third major research approach. This might be attributed to the fact that mixed methods draw from the strengths and minimize the weaknesses of both qualitative and quantitative research.

Qualitative and quantitative purists view their paradigms as the ideal for research which posits that qualitative and quantitative research paradigms, including their associated methods, cannot and should not be mixed (Howe, 1988 in Johnson et al 2004:14). However, others have revealed that both quantitative and qualitative researchers use empirical observations to address research questions, “describe their data, construct explanatory arguments from their data, and speculate about why the outcomes they observed happened as they did” (Sechrest and Sidani (1995:78 in Johnson et al 2004).

By employing mixed methods research, both epistemological and ontological considerations were catered for. Qualitatively, there was an active engagement of the target population and the results were related to the actual lives of the people (interpretivist/constructivist). By this, an in-depth knowledge was obtained by means of inhabitants’ perception of improved water supply and reduction or otherwise in water related diseases. Information on their general wellness for instance could be best explained by the people themselves. On the other hand, the study involved the assessment of the relationship between water supply and health. In this regard, quantitative research helped in the collection of numerical data which will be analyzed to exhibit this relationship (Bryman 2008:140).

Mixed research has been positioned as “the natural complement to traditional qualitative and quantitative research” as it dovetails the different aspects of the study (Bryman 2008:607;

Johnson et al 2004:14) and hence its choice for this research. Semi-structured interviews and observations will be used together with structured interviews to collect data. This will enhance the credibility of the research findings (Bryman 2008:609).

3.3 Sampling

Sampling according to Trochim (2002), connotes the process of selecting units from a population of interest so that by studying the sample a fair generalization could be made from the results back to the population from which they were chosen. Purposive sampling and simple random sampling are often used for qualitative and quantitative research respectively (Bryman 2008). Therefore, a combination of these two sampling methods was appropriate for a mixed methods research. Purposive sampling was used to select communities in the Atwima Mponua District that has benefited from the Water and Sanitation Programme (RWSP - IV) and the Rural Water and Sanitation Intervention (RWSSI). These communities were using water from unsafe sources before this intervention and therefore were able to give information on the concept under review. The same sampling technique was used to select officials from the district assembly. The District Assembly was the main organization that coordinated the implementation of the Water and Sanitation Programme (RWSP - IV) and the Rural Water and Sanitation Intervention (RWSSI). They were therefore in a better position to give information on improved water supply condition in the district. They also gave information on how far the initiative has come in achieving its health related objectives. Officials in the Atwima Mponua District Hospital were also purposely selected for interviewing. This was to get empirical data on the incidence of water related diseases before and after the provision of improved water supply in the district. The main target respondents for the research were community inhabitants who have first-hand experience of the water supply situation in the district. They therefore constitute the majority of the respondents interviewed. Simple random sampling was used to select people from the various communities for structured interview administration. The number of respondents chosen from each community was based on the size of their population. Table 3.1 shows the research method used, respondents involved and the sample size selected.

Table 3.1: An overview of methods, respondents involved and sample size

Method	Respondents	Sample Size
Qualitative interviewing	Atwima Mponua District Assembly	2
	Atwima Mponua District Hospital	2
	Key Informants	5
Structured Interviews (Questionnaires)	Abompe	5
	Beposo	19
	Bedabour	36
	Kyenkyentaa	12
	Kwame Dwaa	16
	Mansaso	14
	Anwiafutu	22

3.4 Data Collection

Data was collected to help answer the research questions. The research made use of both primary and secondary data. The data collection process took place over a three month period from December 2012 to February 2012. It started with the collection of secondary data to know what has already been done in this field, what there is to explore and the gaps that exist. Fieldwork took place in the successive months at the Atwima Mponua District Assembly, the Atwima Mponua District Hospital and the Abompe, Beposo, Bedabour, Kyenkyentaa, Kwame Dwaa, Mansaso and Anwiafutu villages. Interviews took place in the natural setting, in offices and in people's homes in the villages. The data collection process captured both qualitative (non-measurable) and quantitative (measurable) data.

3.5 Qualitative method of data collection

Qualitative research is suited for exploring and understanding the social world through an examination of the interpretation of that world by its participants according to Bryman (2008:366). He further outlines observation, qualitative interviewing, focus group discussion, conversation analysis and document and text analysis. This research chose qualitative interviewing (semi-structured interview) and observation for data collection. This helped to discover how individuals understand or respond to their social world. Cases such as people's health experiences before and after improved water supply as well as people's perception how to make improved water supply sustainable in the district was explored. In-depth information was also made available through from Assembly and Health Officials through qualitative data collection methods.

3.5.1 Qualitative Interview: Semi-Structured Interview

The flexible nature of interviews according to Bryman (2008:436) makes it attractive for qualitative research. Interviewees' perspective, a notable quality of qualitative research is also catered for. What is of most significance to this research is the ability of qualitative interviews to explore topics of particular interest to the target population. For instance, how the people's health was affected before the advent of improved water supply and how they think it is helping improve their health now. Because the researcher has a fairly clear focus coupled with the need to minimize the variation in questions posed to interviewees (Patton 1990:281), an interview guide was designed for the data collection. Nonetheless, interviewees were given the room to interpret their social world as they respond to it and as it affects them. Patton (1990:279) explains that this helps to explore what is on the people's mind and to access what cannot be directly observed. This form of interview was conducted to key informants in the selected communities. Chiefs, Unit Committee members and Elders in the various communities were given open ended interview guides. They were given the room to deviate from the questions set. This yielded a lot of useful information. The real picture of the state of water supply in the communities, the processes they went through to have improved water access and the health benefits accrued so far were explored. It was not enough to know the disease prevalence and

possible reductions, but its effects on families and the community as a whole was made known through the qualitative interviews conducted. Further, what the various leaders have put in place to ensure sustainability was investigated and varied opinions were gathered. Officials in the Atwima Mponua District Assembly were also interviewed with this data collection method. Information on improved water access in the district, and sustainability mechanisms were explored. The Atwima Mponua District Hospital was also consulted to get expertise knowledge on the frequency of water related diseases in the district before and after improved water supply to majority of the populace. This form of data collection gave in-depth first-hand information on the situation at hand.

3.5.2 Observation

To supplement the data collected, unstructured observation was employed. With unstructured observation, the observer participates in the daily lives of the people for a period of time observing behavior, listening to conversations between others and asking questions. One of the most important challenge to this data collection method is how to gain access to the particular social setting (Bryman 2008:403). This challenge was likely to occur. Key informants like the chiefs and unit committee members were therefore consulted for access to the social setting.

For effective observation and ethical reasons, the ‘participant-observer’ role was assumed. The researcher participated in the daily lives of the people and blended with their social setting whilst looking for information and asking questions. This made the people comfortable enough to disclose information they consider as confidential. The communities were predominantly cocoa growing and Kente weaving ones. The researcher normally took part in drying their cocoa beans, and spinning thread for weaving. This made the people comfortable to disclose information that was occasionally asked for. The people were occasionally accompanied to where they access water. Their general wellness and how the water facilities are being utilized and managed were critically observed. This helped minimize problems such as meaning, memory, social desirability effect and question threat that might be associated with interviewing and survey research (Bryman 2008). Pictures were also taken of interesting sites to supplement the information gathered.

3.5.3 Documentary Review

To add-on the data gathered from the primary sources, articles, documents, textbooks and other published data on water were reviewed. These sources were consulted for what have already been done in this field and what there is to discover. However, they were critically probed for authenticity. Peer review articles, textbooks, documents and information from trusted portal sites were thoroughly discussed. It brought out the extensive work done on the subject under review. It further helped in establishing themes and formulating research questions. In addition, various documents were collected from the Atwima Mponua District Assembly. These included documents on water supply coverage in the district, water policies for implementation, district profile and documents on water management among others. These were analyzed and crosschecked with the information gathered from the field. In answering research questions 1 and 2, documents from the district were juxtaposed with that of the respondents. There were cases where the information in the documents tallied with that on the field and vice versa. The Atwima Mponua District Hospital also provided documents on the trend of water related diseases in the district. This was analyzed to supplement the information for research question 3. Disease prevalence and reduction for each year was analyzed along with what respondents said. Although the general prevalence for certain diseases was high for the district per the documents reviewed, that on the ground was significantly reduced.

3.6 Quantitative Research Methods

To maximize reliability and validity, quantitative methods were also followed to measure certain key concepts (Bryman 2008:437). This helped in getting an objective view of the subject under review and time and context free generalization as explained by Johnson and Onwuegbuzie (2004:14). Additionally, quantitative methods eliminate biases, remain emotionally detached and uninvolved with the objects of study and allow empirical testing of theories. In instances where relationships need to be explored, quantitative methods are appropriate. For instance, this research will investigate the relationship between improved water supply and health. Other numerical facts like the proportion of people with access to safe water and the number of people

per water facility will be made possible using quantitative methods. Structured interview will therefore be used as a complementary data collection tool.

3.6.1 Structured Interviewing (Questionnaires)

Although the structured/standardized interview is a data collection tool prominent to both qualitative and quantitative research strategy (Bryman 2008), it was used in this research to replace self-completion questionnaires. Since the majority of the respondents cannot read and write, an interview schedule with predetermined questions was appropriate. Structured interviews also helped to probe respondents, ask many questions relevant to the concept and get additional data. Importantly, the dominant characteristic of low response rate and missing data associated with the self-completion questionnaire was avoided (Bryman). This was administered to the majority of the respondents to get objective data which will help cross check the information from the qualitative data. By this data collection too, the trend of the incidence of water related diseases was traced. Numerical data was generated for the rate of occurrence of water related diseases before and after the advent of improved rural water supply. Since questions were closed ended or pre coded, data interpretation and analysis will be enhanced. The interview schedules (questionnaires) were randomly administered to respondents in the various communities. The parameters of the interview schedule included household demographics, previous state of water supply, current water supply conditions, relationship between improved water supply and health, improved water supply and general wellbeing and management measures in place to ensure sustainability.

3.7 Data Interpretation

The data from semi-structured interviews were recorded using a tape recorder. A note was also taken of interesting themes. Participant observation was recorded in the form of well written field notes and jotted notes from informal conversations. The information was broken down using the concept of coding; the process by which data are broken into component parts that are given names (Bryman 2008:543). But specifically, this study employed open coding; the process

of breaking down, examining, comparing, conceptualizing and categorizing data. These data were transcribed, coded and various themes derived. It brought out people's opinions about how improved water supply has affected health and what could be done to make rural water supply sustainable. The copious data collected was grouped into concepts from which categories were generated. The main themes that emerged were expansively discussed to generate a substantive theory as well as to confirm or otherwise the propositions made from the beginning. Quantitative data was analyzed using SPSS. Much of the data generated were more of words than numbers. They were therefore coded to give it numerical values. From that, univariate and bivariate analysis were done using descriptive statistics tools as frequency tables, bars and charts to answer the research questions. Univariate analysis was used for single variables to establish frequencies; how many of the respondents fall into a particular category. Bivariate analysis was also used to establish relationships between two sets of variables.

3.8 Ethical Considerations

Ethical consideration is one of the crucial aspects of social research. As explained by Spencer et al (2003 in Bryman 2008:125) the list of criteria for assessing the quality of qualitative studies embraces the criterion 'evidence of consideration of ethical issues'. These ethical principles have been broken down into four main areas by Diener and Crandall (1978 in Bryman 2008:118) namely harm to participants, lack of informed consent, invasion of privacy and whether deception is involved. The study area for the research was predominantly rural. It is a homogenous society which makes the presence of any outsider fairly noticeable. Getting access to the community without confrontations with the inhabitants was therefore considered. Chiefs and opinion leaders were consulted for permission before interviews and questionnaire administration. Individuals approached were also informed of the subject matter of the research and the purpose of the data collected. Their due consent was therefore sought before questions were asked. Officials of the Atwima Mponua District Assembly and Hospitals were given formal notification before interviewing. They were also given a note explaining the purpose of the research and the anonymity of respondents. The Ghanaian rural setting does not compromise on morals. Therefore, care was taken in approaching respondents; the elderly, chiefs and unit committee members. Care was also taken in the asking and interpretation of questions. Questions

like disease prevalence in households and community were quite sensitive. These were tactfully asked to elicit the needed response. There were cases where certain households had lost family members or had family members disabled due to water related diseases. Not to stir up their pain, interview sections were made as informal as possible. Confidentiality, anonymity and strict use of the information for research use were stressed throughout the interview process. With the observation, the researcher immersed herself into the social setting (with the people's permission) to get the information needed without interruption in the people's activities.

3.9 Limitations of the Study

Most of the respondents in various communities were illiterates. That slowed down the data collection process to a large extent. Questions on the interview schedule (questionnaire) had to be read out and translated into the local dialect (Twi) one after the other. In cases where the researcher was not able to offer proper interpretation or translation of questions, meaning was lost. In this case, the exact information needed to answer a particular research question might not be covered. Also, some respondents were sensitive to certain questions about their households. For instance, respondents were prompt to disclose disease prevalence in the community but not for their households. So while they answered 'very high' for the community, they answered 'never' for their households. It therefore required a great deal of probing to get such information. The transportation system that connects villages in the district is fairly poor. This made data collection tedious. Additionally, certain communities could not be reached due to lack of transportation access. This bias in the sampling could affect generalization of the research. Time constrains was also a limitation. Being a student working within a stipulated work plan, the researcher could not probe for all the information needed. It was further observed that respondents misinterpreted the presence of researchers for charity organizations. They therefore answered questions so as to suit the researcher. In a nut shell, the real situation might not be explored. It was fairly easy to get results as 'improved water supply has reduced the incidence of water related diseases'. But devising variables/indicators to measure the margin or degree of reduction was not easy. Both qualitative and quantitative research strategy were used to maintain validity and reliability.

CHAPTER 4

EMPIRICAL PRESENTATION OF FINDINGS AND ANALYSIS

4.0 Introduction

The chapter presents the empirical findings and analysis of the study against the literature reviewed and the theoretical framework. The chapter is divided into six parts tailored to answer the six research questions and ultimately help achieve the research objectives. The first part deals with the improvement of rural water supply over the past seven years in the district. Under this, the water supply sources before and after the implementation of the Rural Water Supply and Sanitation Initiative (RWSSI) and water provision programs in the district were investigated. Again, water supply quality and rate of supply before and after the interventions were compared to observe if there has been any tangible improvement. Part two deals with the extent of accessibility of improved water supply in the district. Previous and current improved water access was critically examined. To get a clearer insight about accessibility, the study probed into the likely “pushing factors” that might urge people to access their previous water source. The third part examines the actors that are responsible for the provision of the current facilities and its maintenance. The various policies that made the current water facilities available were outlined against their source of funding. Community perspectives on who is responsible for the provision and maintenance of water facilities were also investigated. Part four presents the core of the study; the health implications of improved water supply. Under this, the prevalent water related diseases before and after the current water facilities were explored. This was done to explore the relationship between improved water supply and the incidence of water related diseases (WRDs). Documents from the district health directorate, district hospital and district assembly were juxtaposed with community perspectives to find out the trend of WRDs incidence before and after the provision of improved water supply. Specific WRDs cases were explored. The diseases selected included diarrhea, worm infestation, malaria, buruli ulcer and bilharzia. The fifth part analyzed the impact of improved water supply on the general well-being of the people. This included economic and gender related improvements and general living conditions. The last part

assessed the water management mechanisms in place and how effective they are. It further investigated the role of community, government and a possible collaboration in water supply provision and maintenance. Rainwater harvesting was also identified as a potential viable source of improved water supply. A summarized analysis of the research findings is provided at the latter part of this chapter. The chapter concludes with a validity discussion on the findings of the study.

PART 1: Rural Water Supply Improvement over the Last Seven Years

This section analyses the improvement of rural water supply in the district (with special emphasis on the communities selected) from 2005 to date. This would not have been possible without critical exploration of previous and current water source, water quality and supply rate. Respondents from six different communities were interviewed on the concepts under review. This ranges from district assembly officials, chiefs and unit committee members and community inhabitants. It was realized that, although opinions were the same on some matters, people had different meanings to different situations.

4.1 Community Water Supply Sources Before and After the Introduction of the RWSSI

The main water sources in the District before the advent of the Rural Water Supply and Sanitation Initiative (RWSSI) in 2005 were hand-dug wells, boreholes, River Offin and other streams. Only two towns in the District have pipe borne water. Nyinahin has a small town water system while Mpasatia is served by the Ghana Water Company's Owabi Dam from Nkawie. According to the District Assembly, only 45.2% of the communities in the District had water supply from boreholes and hand-dug wells. The remaining communities resorted to streams, dugouts and any other source they found water. This confirms Gyau-Boakye's (2001) assertion that in Ghana, rural communities have traditionally depended on surface and groundwater sources for their water supply needs. These surface water sources include dug-wells, ponds, dugouts, impoundments from dams, ephemeral streams and rainwater harvesting from roofs. About 91% of the respondents therefore pointed to River Offin (surface water) as their main water

source before the RWSSI in 2005. Communities like Mansaso and Anwiafutu had other streams beside River Offin to depend on. These small streams easily dried up in dry seasons. In rainy seasons, the people often resorted to rainwater harvesting with containers they had in the house. However, the roof for harvesting rainwater could become dirty with dust and other impurities which made the water harvested unwholesome for drinking. Below is a frequency table for previous water source for the district:

Table 4.1: Previous Water Source in the Atwima Mponua District

Water supply source	Frequency	Percent
Surface Water	113	91.1
Borehole	4	3.2
Hand dug well	5	4.0
Surface water and hand dug well	2	1.6
Total	124	100

Source: Fieldwork 2013

Below is a picture of the main water supply source (River Offin) before the RWSSI.

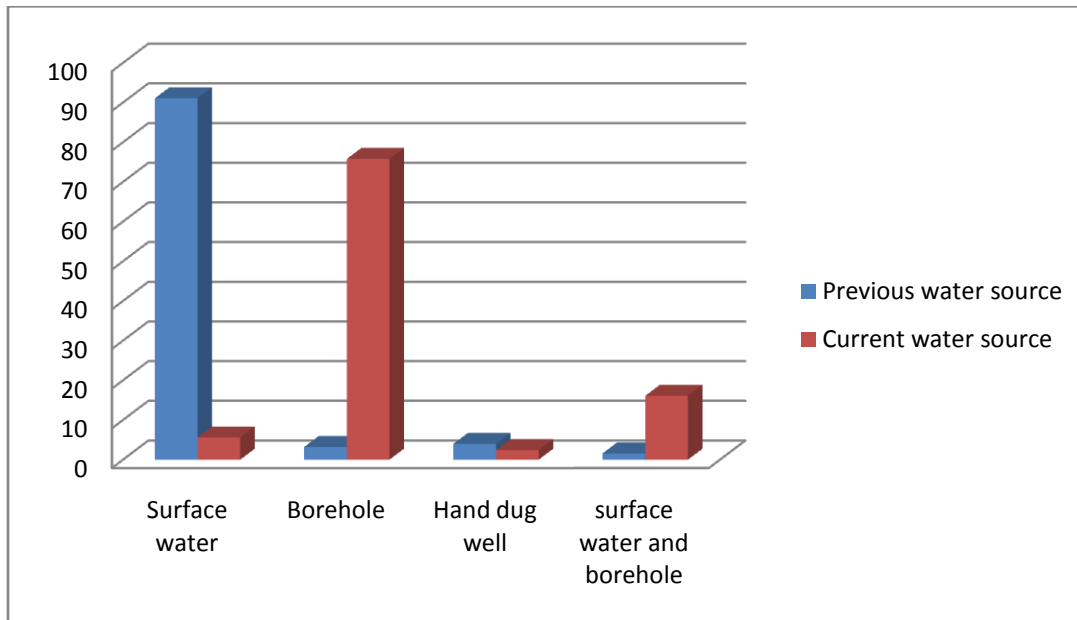
Plate 4.1: Previous Water Supply Source; River Offin



Source: Author's Fieldwork 2013

Using the National Water Sector Planning thresholds of 1: 300 for a borehole and 1: 150 for a hand-dug well, the District with an estimated population of 143,303 have potable water coverage of about 85.4% from 45.2% before 2005. Almost every community in the district has at least a borehole which the people fetch for direct ingestion. Those who still access surface water and hand-dug wells only use it for washing or cooking which will be boiled before usage. It was revealed from the survey that 76% of the population now access water from boreholes, 2.4% from hand-dug wells and 16% from both boreholes and hand-dug wells. Only 5.6% still depend solely on surface water for reasons that will be discussed in the subsequent sections. Below is bar graph depicting the difference in previous and current water sources:

Figure 4.1: Previous and Current Water Sources in the Atwima Mponua District



Source: Author's Fieldwork 2013

Figure 4.1 indicates that attention has been shifted from surface water, mainly River Offin, to boreholes. As will be discussed later, the boreholes are much more potable than surface water which is often open to contamination from any source. The boreholes present further prevent and drastically reduce the spread of contagious water related diseases like diarrhea, bilharzia and others. Since there is no direct contact between infected people and the water in the borehole, disease spread is reduced. With surface water, infected people could easily step into streams and

contaminate it for other usage. This situation has changed at least for five out of the six communities interviewed. The Abompe community however still has surface water as their main water source because they claim the borehole that was drilled for them is contaminated. The bedrock of the area has high mineral content which makes the water look rusty and almost impossible to use. Apart from this community and others that might be in this category, the water supply source in the district could be said to have improved.

4.2 Water Supply Quality before and after RWSSI

Although no laboratory test was conducted on River Offin and other small streams that respondents previously depended on, it was realized that the water source was not potable. The Opinion Leaders emphasized the unsafe nature of the surface water. One of the Chiefs explains:

“We have drank Offin for many years not because we did want to or it was so potable but because we had no choice. The district hospital warned us many times that the river was responsible for many sicknesses in this community but what could we had done?” (Field Interview 2013).

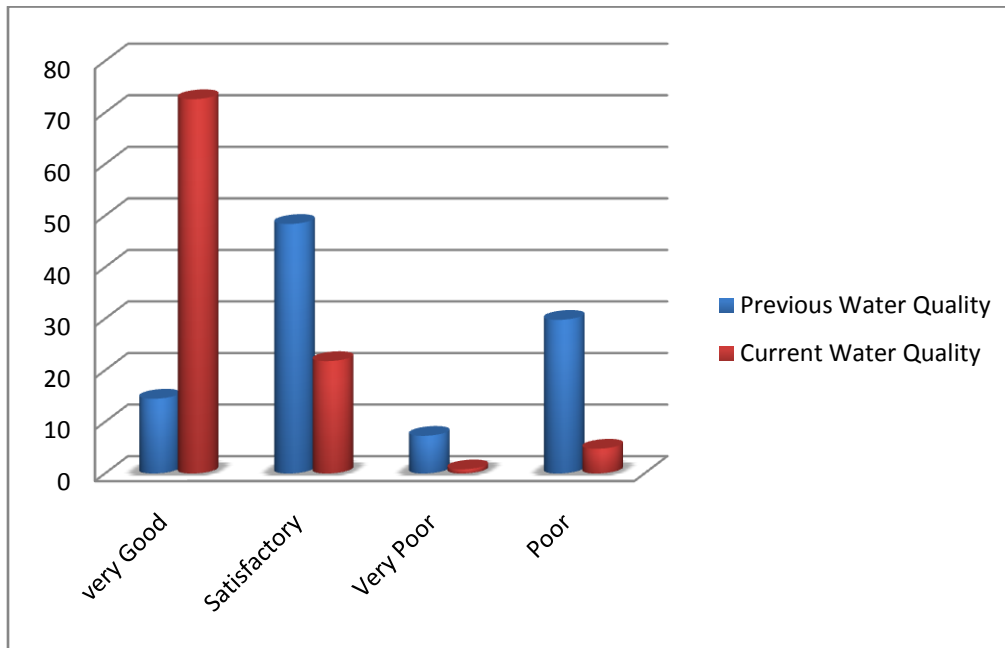
It was observed that due to the open nature of the river, it was exposed to many contaminants from any source. In dry seasons for instance, chemicals like dichlorodiphenyltrichloroethane (DDT) were introduced into it for fishing which made it really polluted. When it happened as such, communities did not have a choice than to use this water supply source. It also had dirt accumulations in it and was not safe for drinking. The villages located at the southern part of the river suffered most from contamination. Villages upstream could bath or throw rubbish into it for those downstream to suffer the consequences. One of the respondents directed this question to the researcher:

“Lady, please go and have a look at the stream from which we used to fetch water. Check the color of the water, look at the dirt in it and tell me if you will ever drink it no matter how thirsty you are? But that was our water source for many years before these boreholes were drilled for us” (Field Interview 2013).

The question that therefore comes to mind is, why didn't these communities come together to build communal wells? Could we therefore say that they were satisfied with the water that gave

diseases or the provision of alternative water source was beyond their means? To make matters worse, “Galamsey” (illegal mining) operators also pollute the water with chemicals. Because River Offin is a relatively big river, they had enough water to “wash” their gold and leave the river unhealthy for drinking. Figure 4.2 below compares previous and current water supply quality:

Figure 4.2 Previous and Current Water Supply Quality in the Atwima Mponua District



Source: Author’s Fieldwork 2013

Figure 4.2 indicates that the situation has changed to a large extent. Water supply is from protected source (boreholes) which is free from most contaminants. About 71% of the respondents said the current water supply quality is “very good” whilst 22% said it is “satisfactory”. Most of the people who responded satisfactory are those who had developed a special taste for the previous water supply. An old woman explained

“I have drunk Offin all my life. Nothing happened to me. They provided this modern water supply that takes only the strong to operate. And one more thing, no matter how much of the borehole water I drink, I never get satisfied” (Field Interview 2013).

People in her category did not see anything wrong with surface water and therefore responded satisfactory to the new water source. Those who responded “poor” and “very poor” to the current water supply are the communities who claim their boreholes have oily and rusty contents that made the water unfit for use. They further said the water from the borehole is hard and thus wastes a lot of soap when one wants to use it for washing. Aside these instances, water quality could be said to have improved significantly in the district because it is now protected, is cleaner and has succeeded in reducing water related disease incidence. Below is a pictorial presentation of the previous and current water quality.

Plate 4.2: Current Water Supply Source from Boreholes



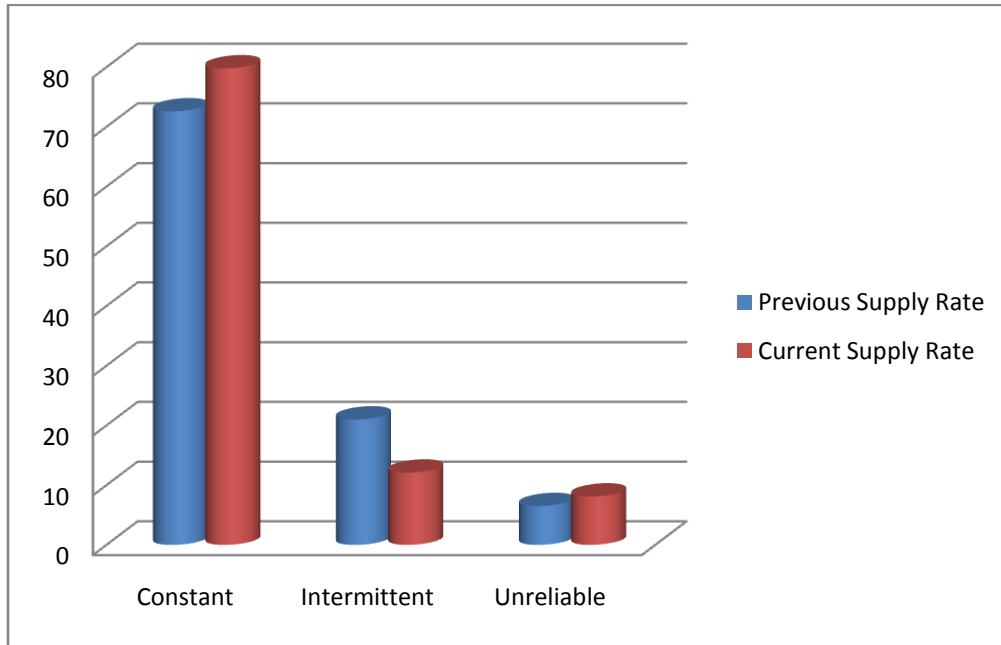
Source: Author’s Fieldwork 2013

4.3 Water Supply Rate

The study revealed that water availability has never been too much of a problem in the district. River Offin is a big river that is available in supply all year round. Even in dry seasons, when small streams get dried up and the rains stop, water is available in the Offin River. In dry seasons however, the river gathers a lot of silt and dirt. People additionally use the river for fishing purpose, sometimes even with the introduction of deadly chemicals. So although water will be

available in this instance, its polluted nature renders it unusable. Other small streams and rivers unfortunately dry up during the dry season resulting in severe shortage of drinking water. Below is a bar chart showing previous and current water supply rate:

Figure 4.3 Previous and Current Water Supply Rate



Source: Author's Fieldwork 2013

According to figure 4.3 above, water supply was not a problem before the provision of boreholes to communities. The water available was however not safe for usage hence the many cases of water related diseases as will be discussed later. Those who responded “unreliable” to the previous water supply are the communities who were using smaller streams other than River Offin. Although the current water supply rate is fairly constant, there are some inconsistencies. About 12% and 8% responded “intermittent” and “unreliable” to the current water supply rate. These responses were received in communities that had frequent breakdowns of water facilities either because they do not operate it well or there are no mechanisms in place to ensure timely repairs and maintenance. In communities where proper management mechanisms are in place, water supply from boreholes and protected hand-dug wells was constant. It could be realized from the above that, it takes both water availability and quality to ensure improved water supply.

Although most communities in the district used to have water supply available all year round, it was not potable and hence the relatively high incidence of water related diseases. Additionally, the water supply source was not protected. This made way for pollution and the easy spread of water related diseases. With the inception of the Rural Water Supply and Sanitation Initiative (RWSSI) and other programs implemented by the District Assembly, boreholes and protected hand-dug wells have been provided. Water supply sources are now protected and it is available at all times for those who properly maintain it. It is potable for drinking by evidence of being able to reduce water related disease incidence.

PART 2: Accessibility of Water Supply

One of the main aims of the Rural Water Supply and Sanitation Initiative (RWSSI) and other water supply programs implemented by the district was to ensure improved water accessibility. The study therefore investigated the accessibility of both previous (surface water) and current (boreholes and hand-dug wells) water supply.

4.4 Previous Water Supply Access

The main water supply source before the drilling of boreholes, River Offin is close to most communities. The river is less than 500m to the majority of households. It therefore required minimum effort for those communities to access water. About 18% and 47% of the respondents had the Offin River “very close” and “close” to them respectively. These people therefore did not have any problem with water access except for quality. Unfortunately however, those who had the river very close also saw community inhabitants mostly children swimming in the river all the time that resulted in water related diseases like bilharzia. Below is a crosstab of communities and previous water supply access:

Table 4.2 Crosstab Showing Communities Previous Water Accessibility

Name of Community	Previous Water Accessibility					
	Very close	Close	Average	Far	Very Far	Total
Abompe	5	0	0	0	0	5
Beposo	1	9	9	0	0	19
Bedabour	9	17	6	2	2	36
KyenKyentaa	0	2	1	5	4	12
Kwame Dwaa	2	1	2	3	8	16
Mansaso	0	7	1	2	4	14
Anwiafutu	1	11	3	5	2	22
Total	18	47	22	17	20	124

Source: Author's Fieldwork 2013

It could be seen that communities like Abompe, Beposo and Bedabour and Anwianfutu have very close and close access to River Offin. In this sense, if there is a way of making the water safe, they wouldn't have had any problem with water supply. The remaining communities, Kyenkyentaa, Kwame Dwaa and Mansaso have the Offin River far away from them. The inhabitants of Kwame Dwaa had to travel about one and half kilometers (1.5km) to access River Offin. Similarly, Kyenkyentaa and Mansaso had to travel for about 1km to access Offin. Mansaso however had other streams that were close by but they completely dry up in dry seasons. In such cases, the people would have to travel far, climbing and descending mountains to access water that is not even potable. This put a lot of stress on the women and children. Some children had to be late or absent themselves from school to ensure water availability for household use. Additionally, key informants revealed that household water demand exceeded supply. Due to the kilometers one had to go in search of water, households had to manage the water available even if they need more for other activities.

4.5 Current Water Supply Access in Atwima Mponua District

About 360 boreholes and 23 Hand-Dug Wells have been constructed under the Rural Water and Sanitation Programme (RWSP - IV) and the Rural Water and Sanitation Intervention (RWSSI).

Improved water access has moved from 48.2% in 2004 to 85.4% in 2012 reaching 276 communities out of 323 in the Atwima Mponua District (Atwima Mponua District Assembly 2012). Almost every community in the district now has at least a borehole. The table below demonstrates the selected communities for the study, their population and the number of boreholes present

Table 4.3: Communities, Population and Number of Boreholes

Community	Population	Number of boreholes
Abompe	342	1
Beposo	793	4 (only one working)
Bedabour	1102	5
KyenKyentaa	96	1
Kwame Dwaa	242	2
Mansaso	313	2
Anwiafutu	2318	7 (only 5 working)

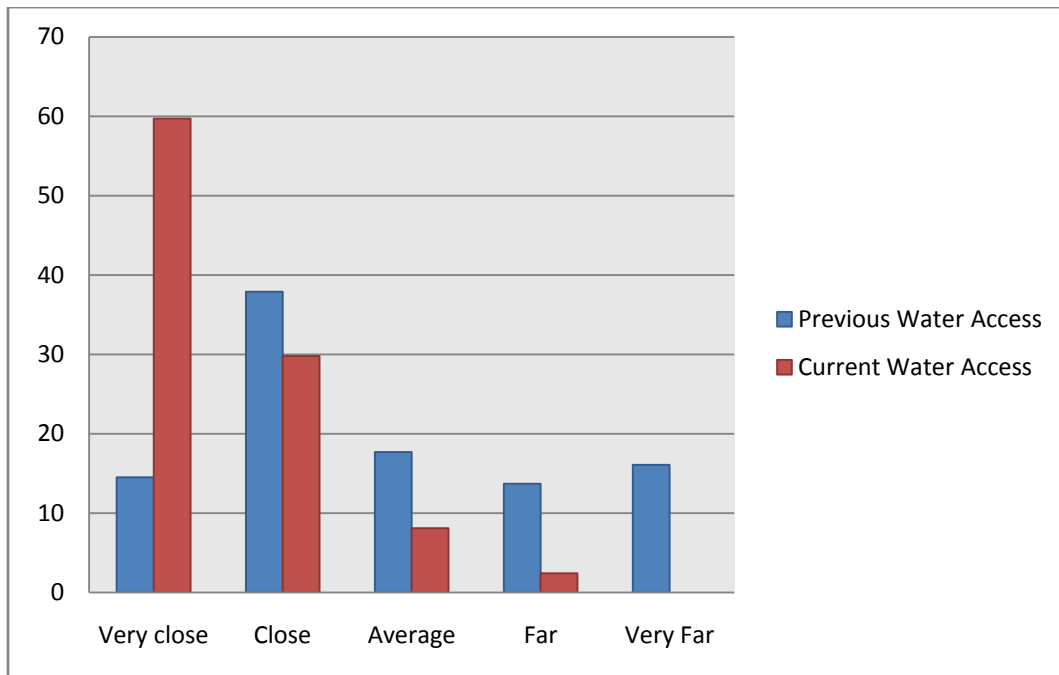
Source: Author's Fieldwork and Atwima Mponua District

It could be deduced from the above that communities have good access to improved water supply. According to the Ghana Community Water and Sanitation Agency (CWSA), one borehole can serve 300 people. Based on this, communities like Kwame Dwaa, Bedabour, KyenKentaa and Mansaso have water supply surplus. However, Beposo and Anwiafutu do not have adequate water supply as some of their boreholes have broken down. The borehole in Abompe is neither safe for drinking nor for domestic purposes according to the community inhabitants. The bedrock has high mineral content which introduces an oily content into the water. As a result, although the community has a borehole, they still access water from River Offin because of the borehole's excessive mineral content. Although Beposo was provided with 4 boreholes, only 1 is working at the moment. The remaining three have broken down and the community has not put any measures in place to ensure repairs and maintenance. In this community also, although water facilities are available, people still resort to unsafe water sources because of the breakdown of water facilities. The remaining communities have "close" and "very close" access to improved water supply. According to one of the respondents,

"You can put your food on fire, walk to the borehole, fetch water and come and pour it on it. This is very different from previously when you have to return from farm and walk for kilometers for a

bucket of water”. Gone are the days when you had to pay the young ones to fetch water for you if you don’t have any grandchild around. Now, even me, an old woman can pick a container and fetch the water I need because it just nearby” (Field Interview 2013).

Figure 4.4: Previous and Current Water Supply Access

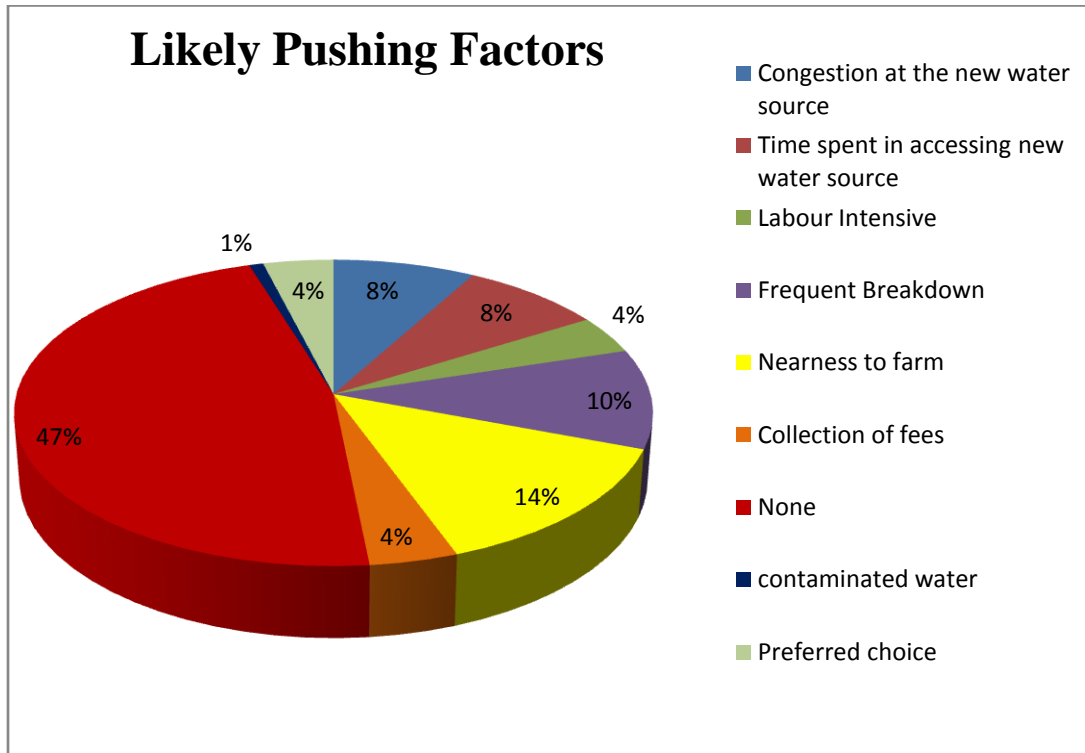


Source: Author’s Fieldwork 2013

Access to improved water supply could be said to have improved to a very large extent. Communities are however increasingly expanding. So although, the whole community used to be close to the boreholes available, some are now relatively far away. Those who responded “average and very far” are those who are now settling at the fringes of communities. Water demand is gradually exceeding supply, hence the pressure on existing water facilities and the resulting frequent breakdown. The seemingly potable water access is somehow deceptive since it does not clearly indicate the condition of the facilities or the quantity of potable water available for domestic use and waiting time at the point sources. The underground water level drops considerably during dry seasons and negatively impact on potential water available in boreholes in the District. The water yield per minute reduces with an attendant increase in waiting time. Some families as a result revert to polluted sources to save time during this time of the year. This

and other “pushing factors” were discovered during the study. Figure 4.5 below illustrates the factors that normally push people to unsafe water sources in the presence of improved water supply.

Figure 4.5: Factors that are likely to push people to unsafe water sources



Source: Author’s Fieldwork 2013

It is therefore evident that although improved water access has significantly increased, there are numerous factors that still force people to use unsafe water source. The predominant occupation in the district is farming (about 72% of the respondents). Most farmers have their farms beyond the river. One woman narrates “we have our farms beyond Offin. So why should I fetch water from the house to the farm when Offin is just close by. Besides it is not proper to cross a river with different water source in your hands” (Field Interview 2013). There is a well-known superstitious belief that one does not have to cross a river with a different water source with them. Anyone caught doing that could be punished by the opinion leaders. People with the farms near the river therefore resort to using the surface water either to avoid problems or because they are used to it. That is why “nearness to farm” accounts for 14% of the pushing factors.

Congestion and time spent at the borehole also go for those communities which have some of their borehole broken down. Perhaps the most surprising factor is the “preferred choice”. One would ask why somebody will prefer surface water to a borehole that is protected and far safer. But those who responded in this manner claim “*the satisfaction one gets from the surface water cannot be compared to this so called modern water*” (Field Interview 2013). Public education needs to be carried out to sensitize people on the need to use water from protected sources. Despite all these factors, the majority of the respondents, 47% maintain the stands that nothing can push them to their previous water supply. This confirms the fact that access to improved water supply has significantly increased in the district.

PART 3: Improved Water Supply Provision; the Master Mind

In pursuit of the Millennium Development Goal, the government of Ghana committed itself to the provision of improved water supply especially for rural dwellers. The Rural Water and Sanitation Programme (RWSP - IV) and the Rural Water and Sanitation Intervention (RWSSI) are among the results of this commitment. This was with funding from the African Development Bank. Among other things the initiative was committed to:

- Increase access to potable water supply to help reduce the incidence of water Related diseases.
- Improve upon the existing water facilities
- Train and increase the number of Area Mechanics for water facilities repairs
- Form and train WATSAN Committees for water facilities maintenance

Aside these two programs, other initiatives like the Community Based Rural Development Project (CBRDP), Government of Ghana (GOG) initiatives and The District Owned Initiative were all in place in ensuring the current water facilities in the district. Table 4.4 below presents the actors that are responsible for the initiation, implementation and funding of water supply programs in the district:

Table 4.4: Actors responsible for the initiation, implementation and funding of water supply programs in the district

S/N	Programs	Responsible for Initiative	Responsible for Implementation	Responsible for Funding
1	Rural Water Supply and Sanitation Initiative Phase I (RWSSI)	African Continent	CWSA/ District Assembly	AfDB
2	Rural Water Supply and Sanitation Initiative Phase II (RWSSI)	African Continent	CWSA/ District Assembly	AfDB (90% Contribution) GOG (5% Contribution) Community (5% Contribution)
3	Rural Water and Sanitation Project Phase IV (RWSP IV)	Germany	CWSA/ District Assembly	KfW (90% Contribution) GOG (5% Contribution) Community (5% Contribution)
4	Community Based Rural Development Project (CBRDP)	Government of Ghana	CWSA/ District Assembly	GOG (95% Contribution) Community (5% Contribution)
5	Government of Ghana (GOG)	Government of Ghana	CWSA/ District Assembly	GOG
6	The District Owned Initiative	District Assembly	District Assembly	DACF/ DDF/ IGF

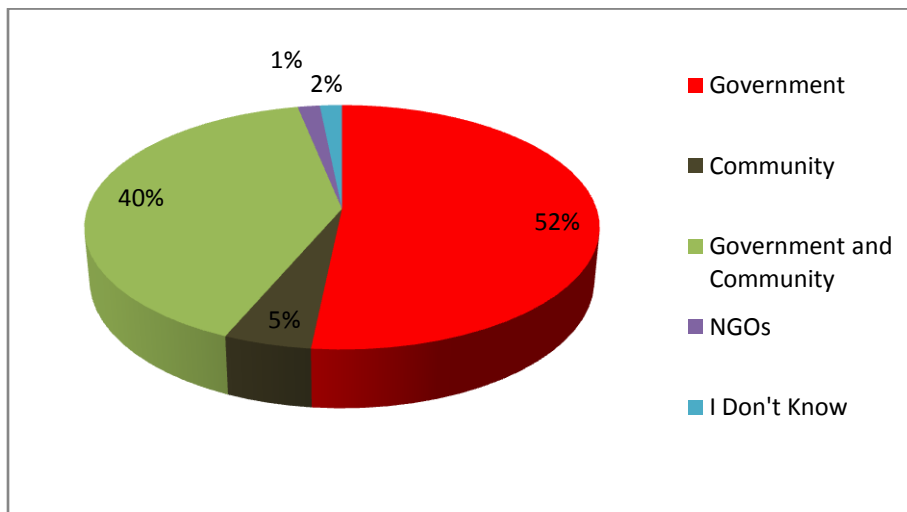
Source: AtwimaMponua District Assembly

The Rural Water Supply and Sanitation Initiative Phase I (RWSSI) was initiated by the African Continent (African Union) and was grasped by the Government of Ghana. This was decentralized for implementation at the district level at which the Atwima Mponua District was a beneficiary. The Rural Water and Sanitation Project Phase IV (RWSP IV) was also initiated by the Germany Government and was implemented by the Community Water and Sanitation Agency (CWSA) with the help of the District Assembly. Aside government and donor country initiatives, the District Assembly on its own also provide water facilities. This is funded mainly with the District Assembly Common Fund (DACF) and sometimes with some contribution on the part of communities. After the provision of water facilities by these actors, communities are expected to have an amount of money in their coffers for maintenance and repairs before the facilities are handed over to them. It was however observed that this is mostly not the case.

4.6 Community Perspective Actors Responsible for Water Supply Provision in the District.

Community perspectives were sought on whether they were aware of the intricacies of the actors responsible in the provision of water supply. The chiefs and opinion leaders who are mostly involved when water facilities are being provided were probed in this direction. Most of them were of the view that the water facilities were provided by the government. For them, any initiative from “above” is from *Aban* (government). A few of them were able to tell the real actors involved. It was revealed that in one of the communities, the district assembly funded 70% of the project whilst the community supported with the remaining 30%. The Assembly has realized that when facilities are provided without any commitment from the community, they do not take proper care of it. This is an emphasis on community participation. The assembly therefore demands a level of commitment on the part of the community. Synergy was therefore in operation in particular communities. Two communities also recounted that the Member of Parliament (MP) for the constituency drilled their boreholes for them in his quest to win their votes. Below are respondents’ perspectives of who is responsible for the provision of the current water facilities in their communities.

Figure 4.6: Community Perspective of Actors Involved In the Provision of Improved Water Supply.



Source: Author's Fieldwork 2013

Although government funding takes the majority of the response (52%), government-community collaboration was revealed to be a potent tool in improved water provision. According to one respondent,

“Once I have committed my money, time and energy into the provision of these facilities, I will not allow people especially children to mishandle it. When it gets spoiled, I will be required to pay again. And it is not easy to find money these days” (Field Interview 2013).

This presumes that once the community commits, they also ensure that their “investment” is not wasted. Communities that are fully committed to maintenance and timely repairs have all their water facilities working. Conversely, the benefits of improved water supply did not last in communities that reneged on their commitment during the projects implementation. The agents responsible for provision of the current water facilities in the district therefore are the Government of Ghana, donor country and agencies, the district assembly and support from community inhabitants. The reasons why some communities have all their facilities functioning and others have theirs broken down will be thoroughly discussed in the later sections.

PART 4: Improved Rural Water Supply; Impact on the Incidence of Water Related Diseases

One of the main objectives of rural water supply programs is to reduce the incidence of water related diseases. Implementation of programs is mostly successful. The evaluation/crosschecking of the results to find out if these objectives are met are seldom done. It is in this light that the study assessed the health implications of the water supply programs by the Atwima Mpnu district.

4.7 Prevalent Water Related Diseases before Improved Water Supply

Water related diseases accounted for half of the top ten diseases in the district. Almost all opinion leaders interviewed admitted that their previous water supply was responsible for many water related diseases in their various communities. The main diseases observed were malaria, bilharzia, worm infestation, buruli ulcer and diarrhea. Several cases of these diseases were recorded. Disease spread was very fast because infected people had frequent contact with water

supply (surface water). This therefore became a great concern to the district. The district health directorate recorded cases of malaria, diarrhea, intestinal worms, onchocerciasis and many cases of buruli ulcer. Malaria successively topped the chart for the “top ten diseases” in the district for years. The number of disease cases reported at the district hospital continued to increase partly due to the increase in the hospitals’ specializations and the emergence of the National Health Insurance Scheme. Below is a table of water related disease incidence prevalence before the provision of improved water supply in the district.

Table 4.5: Water Related Disease Prevalence in the District Before Improved Water Supply (before 2005).

Types of Disease	No. of Cases	% of Total
Malaria	35,079	68.6
Malaria in Pregnancy	346	0.7
Intestinal Worms	5,750	11.2
Diarrhoea	2,436	4.8
Skin Diseases/ Buruli Ulcer	948	1.9

Source: Atwima Mponua District Assembly

The impact of these diseases was enormous with isolated death cases. Additionally, the diseases had some children deformed and landed some households in financial stress. Buruli ulcer has especially deformed some people. Guinea worm infestation for instance left the leg of one woman malfunctioning. They previously thought it has superstitious connection and that is how it affected them that much. Below is a summary of people’s perspective of the impact of water related diseases on their households:

Table 4.6: Effects of Water Related Diseases

Effects of WRD	Frequency	Percentage
Drain of Family Income	52	41.9
Reduction of productive hours	14	11.3
Death as an extreme case	2	1.6
Drain in Income & Reduction in Productive hours	12	9.7
None	43	34.7
Deformity	1	0.8
Total	124	100.0

Source: Author’s Fieldwork 2013

The majority of the respondents (42%) experienced a drain in household incomes. This is because sick members of the family have to be taken care of and this involves hospital attendance and buying of medicine. Loss of productive hours also counted as an effect because sick individuals either could not engage in productive activities or had to spend time taking care of other family members. As explained above, some respondents have lost family members whilst others are deformed. Surprisingly, about 35% of the respondents have not seen any effects on their households. These were the people who claim the previous water supply did not produce any water related disease they can think of. Households recounted their experiences of WRDs to help explore the prevalence of water related diseases. Below are the summary of the results:

Table 4.6 Family Experience of Water Related Diseases

	Frequency	Percent
Always	2	1.6
Most Times	15	12.1
Sometimes	62	50.0
Never	45	36.3
Total	124	100.0

Source: Author's Fieldwork 2013

Exactly half of the respondents have experienced WRDs in their household at some point when they were using the previous water supply. These diseases range from malaria, bilharzia, buruli ulcer, diarrhea, worm infestation among others. Between 2% and 12% of the respondents experienced WRDs always and most times when they were connected to the previous water source. This brings the percentage of households who agree that the previous water source brought about WRDs to 64%, representing the majority of the respondents. Surface water could therefore be said to be a major cause of WRDs in the district. On the other hand, about 36% of the respondents have never experienced WRDs in their households. This was true for families who came to live in the communities after the provision of the current water facilities. Others also felt awkward to disclose that their families have been affected by the diseases enumerated above. Such people responded “very high” for the general community and admitted that WRD had negative effect on their households.

4.8 Water Related Diseases Incidence after Improved Water Supply

All the WRDs in the district records reduced significantly up to more than half its previous incidence with the exception of malaria. This could be attributed to the fact that malaria incidence may have other causes. An interview with the Atwima Mponua District Hospital revealed that improved water supply in the district has played an important role in the change in the trend of water related diseases. This is because the diseases are directly related to water so improvement in water supply has consequentially led to a reduction in disease cases.

Table 4.7 Previous and Current WRDs Incidence

Type of diseases	Previous WRDs Cases	Current WRDs Cases
Malaria	35,079	27,125
Malaria in Pregnancy	346	145
Intestinal Worms	5,750	2,321
Diarrhoea	2,436	563
Skin Diseases/ Buruli Ulcer	948	452

Source: Atwima Mponua District Assembly (2012)

All the WRDs in the district records reduced significantly up to more than half its previous incidence with the exception of malaria. This could be attributed to the fact that malaria incidence may have other causes. An interview with the Atwima Mponua District Hospital revealed that improved water supply in the district has played an important role in the change in the trend of water related diseases. This is because the diseases are directly related to water so improvement in water supply has consequentially led to a reduction in disease cases.

Additionally, it was revealed that WRDs cases that were previously reported have reduced because almost every community in the district has at least a borehole. The situation has therefore changed for the better. Current research by the hospital has however revealed that there are still selected cases of buruli ulcer in certain communities. A diarrhea epidemic was also prevalent in the district in 2011 and 2012. But this is attributed to poor hygiene. Field work in the communities confirmed cases of buruli ulcer even after access to improved water supply. Below is a plate showing a boy infected with buruli ulcer:

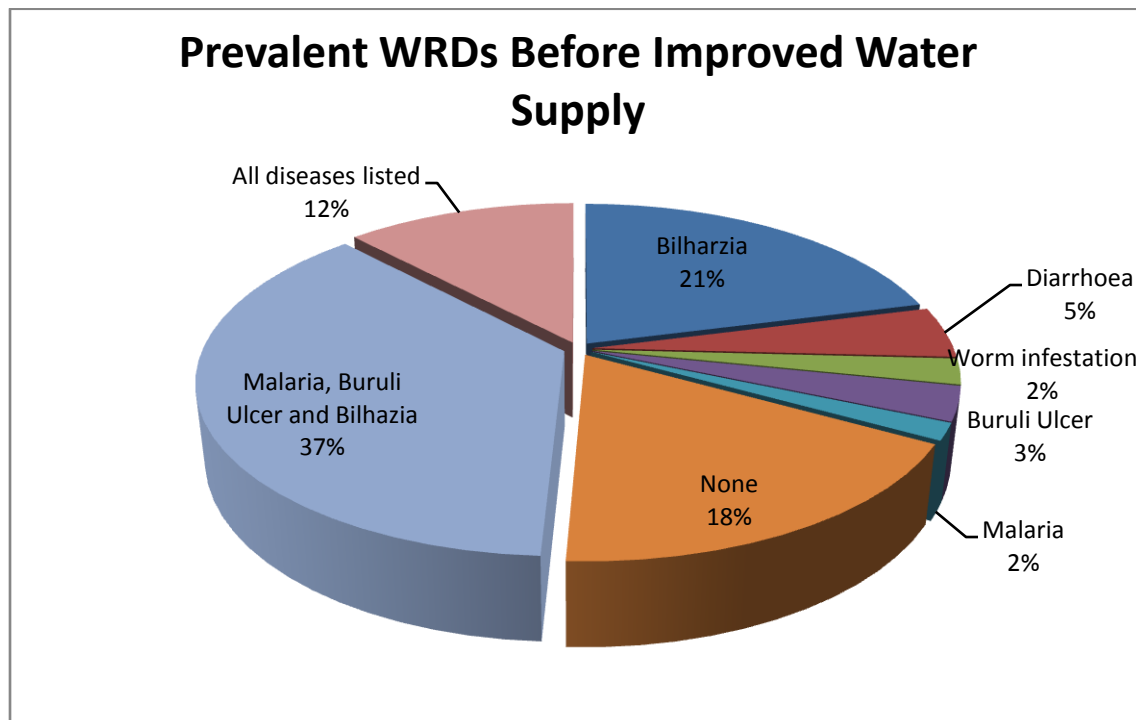
Plate 4.3: A Leg Infected With Buruli Ulcer



Source: WHO 2013

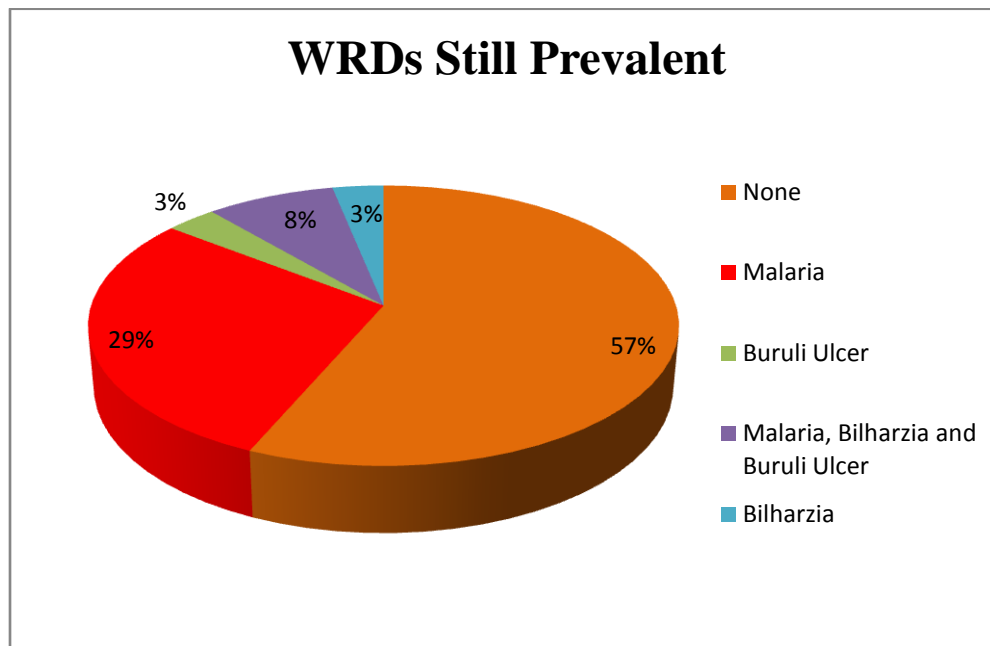
Response from communities reflected that there has been a significant reduction in water WRDs incidence after the provision of improved water supply. Interviews with key informants pointed out that most WRDs are now totally absent. Those that are still prevalent happen as isolated cases with the exception of malaria. Below is a community perspective of WRDs incidence before and after improved water supply.

Figure 4.7: Community Perspective of Previous WRDs Prevalence



Source: Author's Fieldwork 2013

Figure 4.8 WRDs still prevalent



Source: Author's Fieldwork 2013

A combination of malaria, buruli ulcer and bilharzia took the lead (37%) of the most prevalent diseases in communities. This means that at a point in time, all these diseases were present in various communities. This is followed by bilharzia (21%), diarrhea (5%), buruli ulcer (3%), worm infestation (2%) and malaria (2%). All these diseases once existed in the communities according to 12% of the respondents. About 18% of the respondents however claim none of these diseases ever existed in the communities. These are people who lived in the community after the provision of improved water supply or were not willing to disclose the real health situation.

After the provision of improved water supply, more than half (57%) of the respondents admitted that none of these diseases still exist. As a confirmation, malaria still lingers around 29% of the response. Although there is no direct analysis or linkage directly pointing to improved water supply and WRDs incidence, inferences could be made. Records from the district assembly

indicate that WRDs incidence which was one of the districts foremost problems have reduced. This happened after the provision of improved water supply. Empirical cases from the District Health Hospital revealed that improved water supply has played a significant role in the reduction of water related diseases. Water sources are protected which prevents infected people from easily infecting others. Key informants also confirm that WRDs prevalence in their various communities has reduced whilst some are totally absent with the presence of improved water supply. Community perspectives on WRDs prevalence before and after the provision of current water supply facilities indicate a significant reduction. This excludes malaria and isolated cases of other WRDs. To further explore the connection between WRDs and improved water supply, households were asked whether their family experience of WRDs have changed with the inception of the current water faculties. More than half of the respondents (about 60%) claim that family experiences of WRDs are now totally absent.

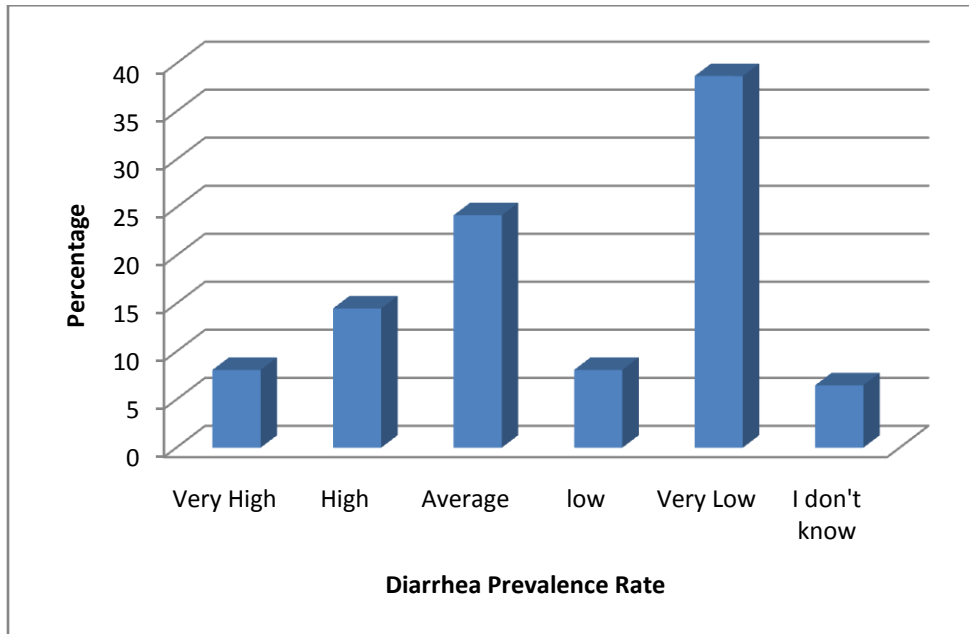
4.9 Specific Cases of WRDs Incidence

To get a clear insight of various WRDs, the study explored them singularly. These included diarrhea, worm infestation, malaria, buruli ulcer and bilharzia. The degree of their prevalence before improved water supply in the rural communities was investigated. This was juxtaposed with its incidence level now.

4.9.1 Specific Case 1: Diarrhea

Diarrhea is among the top ten diseases in the district. The district hospital has it that the number of out and in patient cases was relatively high before the current water supply situation in the rural communities. There were frequent diarrhea epidemics which even claimed lives at the extreme case according to some key informants interviewed. Community response revealed that, poor sanitation due to lack of adequate water supply was a major cause of this disease. In this light, infected people who do not wash their hands properly after visiting the toilet could easily transfer the disease through the surface water. Single cases gradually spread to half a community through this process. It was realized that some respondents felt uncomfortable disclosing their experience, adding that they might not know whether their neighbors also experienced it. Below is a summary of community response on diarrhea prevalence in the district:

Figure 4.9: Diarrhea prevalence in communities before improved water supply



Source: Author's Fieldwork 2013

The response confirmed the existence of diarrhea in the district before the advent of improved water supply. However, respondents had different perspectives on its degree of occurrence. This degree of prevalence varied from community to community. About 15% and 8% responded “high” and “very high” respectively. These were people who had experienced diarrhea in their households and community most of the time. Twenty four percent said this disease occur on the average degree whilst as many as 47% falls into the “low” and “very low” category. The remaining 8% claim not to have any idea of the prevalence of diarrhea. This information together with empirical cases from the District Hospital and interviews with the District Assembly confirms the existence of diarrhea in the district before improved water supply. The study further probed the change in diarrhea prevalence after the provision of improved water supply. The table below summarizes the results:

Table 4.8: Change in Diarrhea Prevalence

	Frequency	Percent
Significantly reduced	50	40.3
Reduced but not significant	17	13.7
Same prevalence rate	44	35.5
Increase in its prevalence	1	.8
I don't know	12	9.7
Total	124	100.0

Source: Author's Fieldwork 2013

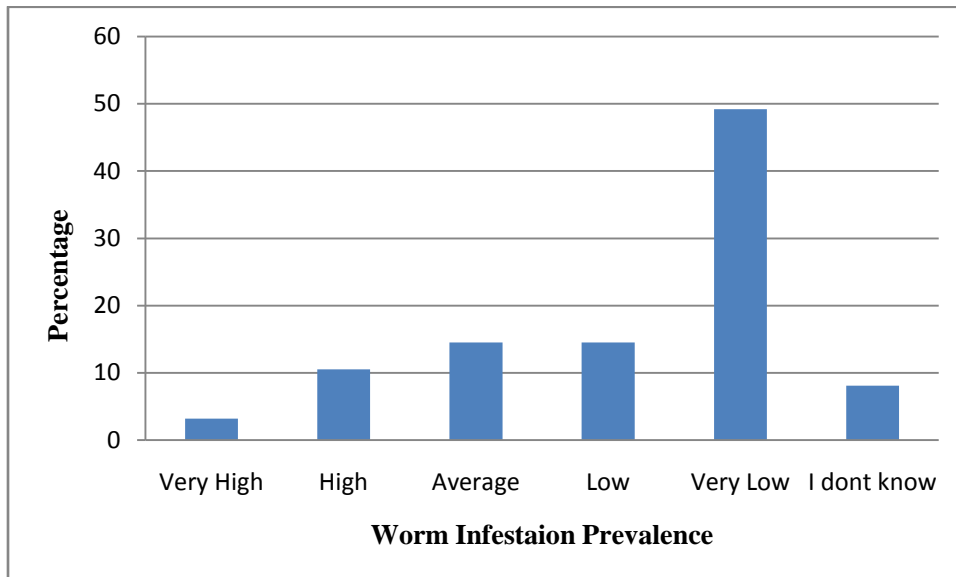
Forty percent of the respondents affirm a significant reduction in diarrhea prevalence in the district. This is a confirmation of the direct relationship between improved water supply and the incidence of water related disease. It further confirms Mensah's (1999) assertion of a direct link between water and the human body. Consuming unclean water therefore affects human health as seen in the previous occurrence of diarrhea. Despite a reduction in incidence, 13.7% of the respondents maintain that the reduction is not significant because cases of diarrhea are still evident. About 36% think the situation has not really changed. Only 0.8% holds that the prevalence has increased whilst the rest do not know what has happened to the situation. Assessing it from this view, the 37 % in the categories of same and increase in prevalence shows that the project has failed to provide the community with the required state of the art water facility that can reduce the disease significantly.

4.9.2 Specific Case 2: Worm Infestation

Worm infestation (intestinal worms) constitutes part of the health burden in the district. This disease has a direct link with the drinking water an individual ingests. The main process of infection is through the mouth apart from guinea worm which could infest through other parts of the body. In this direction, contact with surface water with these worms present automatically puts one at risk. The district Hospital confirms the presence of guinea worm and other intestinal worms in the Offin River, the main source of drinking water in the district before the drilling of boreholes. As a result, a section of the population in the district especially children who liked playing in the river got infested. The district recorded as many as 5,750 cases representing 11.2% of the districts' diseases burden before the Rural Water Supply and Sanitation Initiative

(RWSSI). Cases have recently been reduced to 2,321 (6.2%). Below is a summary of the community perspective of the prevalence of worm infestation in the district before the current water supply.

Figure 4.10: Worm Infestation prevalence in communities before improved water supply



Source: Author's Fieldwork 2013

The general response reflects that there was a low prevalence rate for worm infestation in the district. This takes about 64% of the 124 respondents. This is followed by 15% for the average category and 14% for the “high” category. There is therefore a confirmation of the records from the District Hospital and Assembly. However, prevalence is not as high as they claimed to be. To the people, although worm infestation existed before improved water supply, it was not alarming as to result in deaths except guinea worm infestation that deformed a few people. Most households had developed preventive mechanisms of taking “anti-worm” drugs every three months. This was an education given by the district hospital. Those who followed this directive were not affected much although they were using surface water. This low prevalence has reduced even more after the provision of the current water system as shown below:

Table 4.9: Change in Worm Infestation Prevalence

	Frequency	Percent
Significantly reduced	54	43.5
Reduced but not significant	16	12.9
Same prevalence rate	45	36.3
Increase in its prevalence	2	1.6
I don't know	7	5.6
Total	124	100.0

Source: Author's Fieldwork 2013

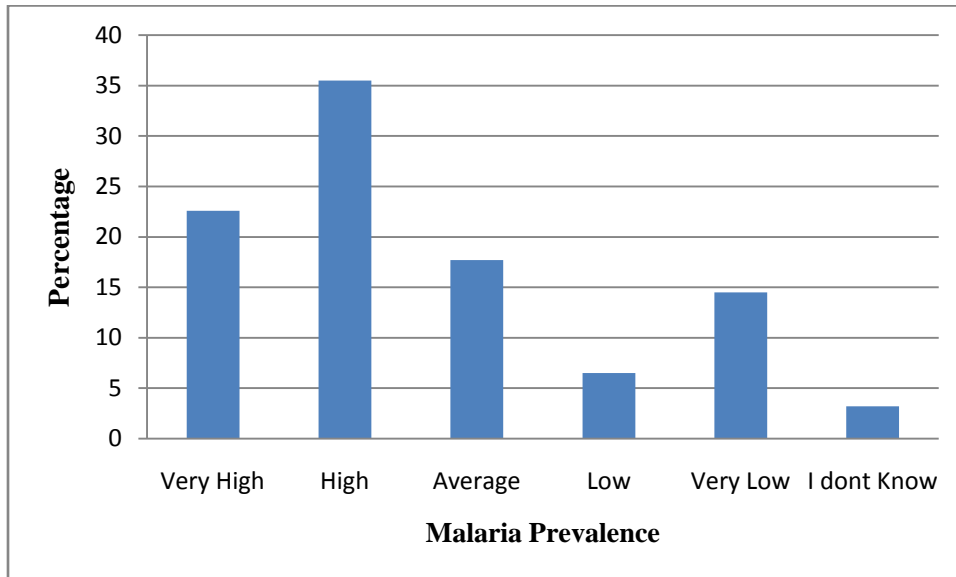
From the table more than half of the respondents admit a level of reduction in this WRD. This is broken down into 44% who knows the reduction is significant and 13% who think the reduction is not significant because some selected cases still exist. Another 36% thinks the improved water supply has not had any effect on the prevalence of worm infestation. This refers to communities whose boreholes are broken down or who still access water from River Offin because of “pushing factors” explained above. It could also be inferred that the cause of worm infestation might not only be drinking unsafe water but from food also. In this case, even if the people do not get it from water, they might get it somewhere else which will make the situation remain the same.

4.9.3 Specific Case 3 Malaria

Malaria constitutes a considerable part of the global health burden. The situation is particularly pronounced in most parts of Africa and Ghana for that matter where the temperature supports mosquito breeding. Undeniably, malaria has topped the disease chart of the Atwima Mponua District for years. What is more pronounced is malaria during pregnancy which acts as a setback in reducing maternal mortality. Malaria constituted about 69% of the health burden of the Atwima Mponua District. Although the situation has changed to some extent, the District Health Directorate has it that there is still a long way to go. Malaria prevalence was high in the district previously because of the presence of dug-outs in search of water. These dug-outs provided breeding grounds for mosquitoes. With the drilling of boreholes, it was observed that almost all the dug-outs have been filled. This, to some extent has controlled mosquito breeding. However,

during wet seasons, flooding from surrounding rivers especially River Offin still leaves pools of stagnant water where mosquitoes breed. Interviews with key informants therefore revealed that, malaria prevalence rate is high in wet seasons than in dry seasons.

Figure 4.11: Malaria prevalence before improved water supply



Source: Author's Fieldwork 2013

Figure 4.11 illustrates that 60% of the respondents fell in the “high” and “very high” categories which affirm the degree of prevalence of malaria in the district. The “average” category takes 18% followed by the “very low” and “low”. Those who think malaria had a low prevalent rate are likely to be those who sleep in mosquito nets or use other mosquito repellents. A respondent narrates: *“all my family members sleep in mosquito nets because mosquitoes have always been part of our lives. But ever since we started sleeping in mosquito nets, none of my children or grandchildren has ever been infected with malaria”*(Field Interview 2013)As mentioned, respondents seem not to have seen any change in malaria prevalence with the provision of the new water facilities. *“Malaria has been part of our lives since time immemorial. I just bought medicine for one of my children and I am still in the process of recovering from mine so I have personally not seen any reduction with this new water supply system”* (Field Interview 2013). Below is the perceived change in malaria prevalence in the district.

Table 4.10: Change in Malaria Prevalence

	Frequency	Percent
Significantly reduced	39	31.4
Reduced but not significant	48	38.7
Same prevalence rate	29	23.4
Increase in its prevalence	3	2.4
I don't know	5	4.0
Total	124	100.0

Source: Author's Fieldwork 2013

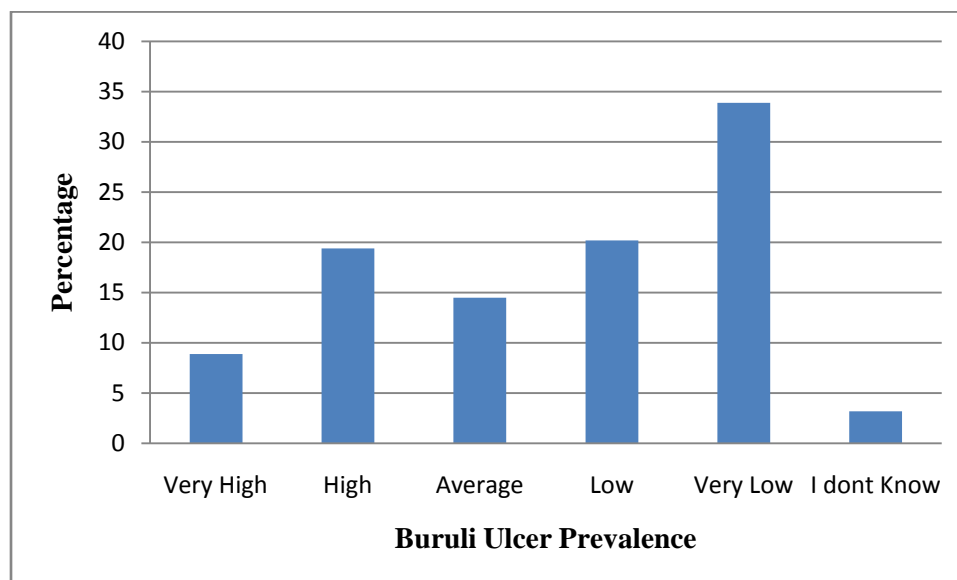
The general response portrays a reduction to some extent in malaria prevalence. But this reduction is not visible enough as 24% assume same prevalence whilst a few even think malaria prevalence is on the increase. It could be observed that improved water supply does not have a direct link with malaria. Although dug-outs are no longer existent, occasional flooding and stagnant water in cans make mosquito breeding unavoidable. What this study gathers from this is that even with improved water supply in place, people need to adopt other preventive measures as sleeping in mosquito nets.

4.9.4 Specific Case 4: Buruli Ulcer

According to WHO (2013), buruli ulcer is caused by *Mycobacterium ulcerans* that mainly affects the skin and can also affect the bone. It has been reported in about 30 countries with tropical and subtropical climates. The disease mainly affects poor rural communities. Buruli ulcer starts as a painless, mobile swelling in the skin which leads to extensive destruction of skin with the formation of large ulcers usually on the legs or arms (WHO 2013). It was observed that the knowledge of buruli ulcer and other skin diseases was not known to the people. They therefore attributed the cause of the disease to superstitious beliefs which made its effects enormous as compared to other WRDs. Some attributed its causes to witchcraft and curses. Although its incidence was relatively low, lack of knowledge prevented the people from seeking immediate medical attention. Also, financial difficulties, fear of the mutilating aspects of treatment, and social stigma delay patients in obtaining treatment (Stienstra et al 2002). There are cases of permanent deformities and deaths from buruli ulcer. One woman narrates, “*My sister-in-law was affected by this disease. She assumed it was her rival that has placed a curse on her and*

therefore started seeking spiritual consultation. Nothing we said could change her mind. Eventually one of her legs had to be amputated” (Field Interview 2013). According to Stienstra et al (2002) common causes of the disease include poor personal hygiene due to water shortages, environment, and close contact with a patient with this disease. Below is a result of respondents’ view of buruli ulcer prevalence before and after the provision of improved water supply:

Figure 4.12: Buruli Ulcer Prevalence before Improved Water Supply



Source: Author’s Fieldwork 2013

Table 4.11: Change in Buruli Ulcer Prevalence

	Frequency	Percent
Significantly Reduced	68	54.8
Reduced but not significant	20	16.1
Same prevalence rate	30	24.2
Increase in its prevalence	1	0.8
I don’t know	5	4.0
Total	124	100.0

Source: Author’s Fieldwork 2013

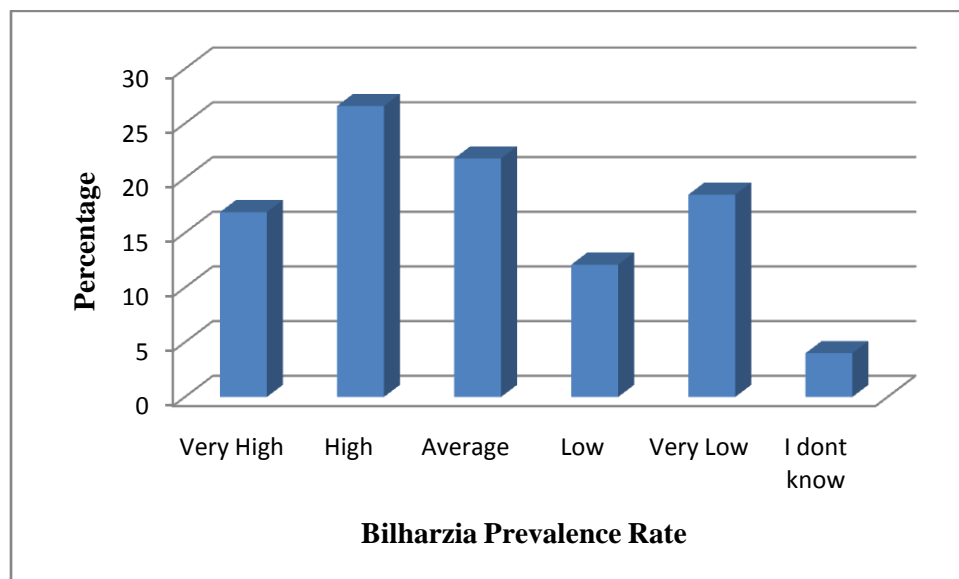
The general response depicts a relatively high prevalence of the disease before improved water supply. Close to 30% of respondents suggest a high incidence of the disease whilst 15% thinks it

was on the average. This shows that the sickness was truly existent in the district under review. Some communities however experienced this disease on a very low prevalence as shown in figure 4.11 above. Table 4.11 shows the relationship between improved water supply and buruli ulcer incidence. More than half of the respondents admitted that improved water supply has significantly reduced the prevalence of buruli ulcer. This is against 16% of the respondents who believe the reduction is not so visible. The 24% whose score belongs to “same prevalence rate” are the people in communities with very low prevalence rate. In all, it could be seen that although selected cases still exist as showed in Plate 2 above, improved water supply together with education on the diseases has significantly reduced its prevalence.

4.9.5 Specific Case 5: Bilharzia (Schistosomiasis)

Bilharzia (schistosomiasis) is a type of infection caused by parasites that live in fresh water, such as rivers or lakes. The infection is prevalent in subtropical and tropical regions, in poor communities without potable water and adequate sanitation (NHS 2013; WHO 2013). According to WHO (2013), the disease is acquired when people come into contact with fresh water infested with the larval forms (cercariae) of parasitic blood flukes, known as schistosomes. The symptoms of this disease can develop a few weeks after someone is infected by the parasite and include a skin rash, high temperature (fever) above 38C (100.4F) muscle aches bloody diarrhea and urination, abdominal pain or cramps and vomiting blood (NHS 2013). Bilharzia is not part of the mainstream diseases that affect the district according to the district health directorate. However, its prevalence in the various communities was very high before the provision of improved water supply. Respondents revealed that, the disease was mainly spread through the Offin River. When infected persons swim in it, they leave the causative agents which spread to others who have contact with the river. The disease mainly affected children who liked swimming in the river. In this regard, communities that are close to the river had the highest incidence because it was relatively easy for children to access the river. Below is the outline of its prevalence in the district before and after the provision of improved water supply:

Figure 4.13: Bilharzia Prevalence before Improved Water Supply



Source: Author's Fieldwork 2013

Table 4.12: Change in Bilharzia Prevalence

	Frequency	Percent
Significantly reduced	80	64.5
Reduced but not significant	11	8.9
Same prevalence rate	25	20.2
Increase in its prevalence	1	.8
I don't know	7	5.6
Total	124	100.0

Source: Author's Fieldwork 2013

From figure 4.13 above, the prevalence of bilharzia is confirmed to be very high in most communities in the district before the provision of improved water supply. The “high” and “very high” categories scored 44% of respondents depicting the degree of occurrence of the disease. About 22% further emphasize the existence of the disease although on the average basis. Those who belong to the “low” and “very low” category are respondents whose communities were far from the river. More than half of the respondents (65%) agree that improved water supply has significantly reduced the incidence of this particular disease. According to mothers among the respondents, there is no need to send their children to the rivers again for water. Children are

now prevented from swimming in the rivers and they do not have any excuse to go there as boreholes are available. In communities where the boreholes are broken down however, children especially still fetch water from the river, get opportunity to swim and thus get infected with the disease. This is depicted by the 20% scored by “same prevalence rate”.

PART 5: Improved Water Supply; Impact on Livelihood and General Well-Being

Improved water supply is critical to human development since water plays an indispensable role in all facets of life (UNDP 2012; UNFPA 2003). Available literature emphasize that water affects all aspects of daily activities. At the higher level, access to safe water is regarded a universal basic right. Denial of this right has inevitable consequences on livelihood and well-being. Rural water supply plays varieties of roles in the lives of beneficiaries. This ranges from economic, gender to general living conditions. The state of living free from the WRDs discussed above is largely dependent on access to safe water. Women who fetch water from far places at the expense of productive activities can work to increase household income if safe water is readily accessible. This and many other impacts of improved water supply as portrayed in the Atwima Mponua District are discussed below.

4.10 Economic Related Impacts

Improved water supply in the rural setting has both direct and indirect impact on peoples’ economic activities. Frequent sickness from WRDs prevents people from active engagement in productive activities. This leads to loss in man hours and consequent reduction in household incomes. The money spent on treating WRDs also poses a financial burden on households. Absence of WRDs therefore means extra income for the household. Most rural women as revealed by the study operate as food vendors, palm oil processors and “iced water sellers”. Ready access to improved water supply was revealed to have a positive impact on these activities. One woman narrates

“I used to travel for about 1.5km to access water for this oil palm processing. The water was even not safe. This made the work very stressful and I was able to do only a little at a time. As you can see, the borehole is only a stone throw from here. I can now process as much as I can, no need to worry about water. In this way, I get more money to support my husband and family” (Field Interview 2013).

Below is a plate showing persons whose occupation has been enhanced due to improved water supply. Water is now readily available for their palm oil processing.

Plate 4.4: Occupation Enhancement by Improved Water Supply

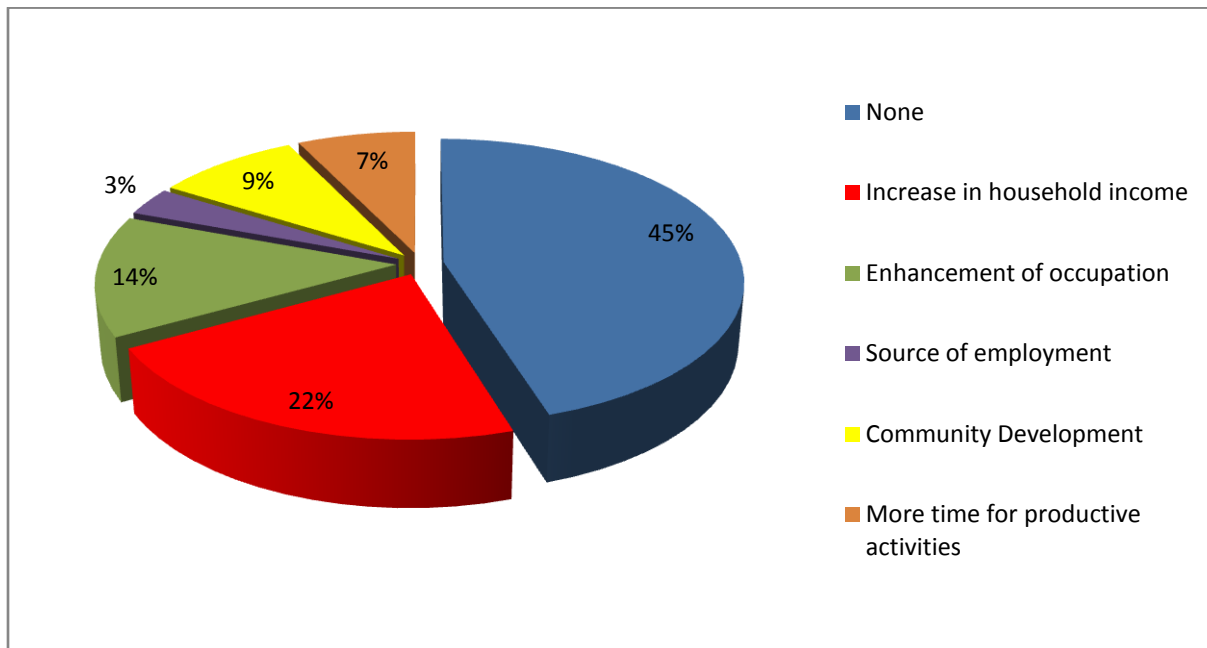


Source: Author's Fieldwork 2013

Communities like Kyenkyentaa and Mansaso are able to undertake developmental projects from the user fees collected from the new water supply system. These communities have a mechanism in place to collect monthly dues which is deposited in the bank. From this money, Kyenkyentaa has been able to build a public toilet facility. One of the opinion leaders recount *“we collect water user fees monthly which the community keeps at the bank and uses it for developmental*

projects like toilet facilities” (Field interview 2013). On the contrary, communities without these mechanisms in place hardly see any economic related improvements. A community like Beposo has 4 of the 5 boreholes broken down. There is no money available for repairs left alone surplus for community development. There seems to be a correlation therefore before water facility maintenance and economic improvements. Below is a cross-section of economic related improvements accrued from the current water supply system:

Figure 4.14: Economic Related Improvements of Improved Water Supply



Source: Author's Fieldwork

As discussed above, those with their water facilities broken down has not seen much of economic improvements whilst those with theirs intact have seen one benefit or the other. Almost half (45%) of the respondents are in the former category and claim not to have experienced any economic improvement. However, more than half are enjoying various economic benefits namely increase in household income, enhancement of occupation, source of employment, community development and more time for productive activities.

4.11 Gender Related Improvements

This section explores the benefits women derive from the current water supply system. According to Sullivan (2001), one concept that is mostly neglected and yet crucial to national development is the time spent by women in collecting water from far places at the expense of productive activities. Lack of improved water affects the lives of women and children in no small way. The study confirms that most women in rural areas spend a considerable amount of time looking for water for the household. This leaves them little or no time to engage in productive activities. Female children who assist their mothers in household water provision put their schooling at risk. School time would have passed by the time they travel 1.5 km for four to five times in search of water. In addition, the stress involved in the process put the health of women and children at risk. According to one opinion leader,

“Women benefit most from ready access to improved water supply. They no longer have to wake up 3am in the morning or at night in search of water. They are even more vulnerable in dry seasons when the nearby streams dry up. The distance to water access point increases and so does their stress” (Field Interview 2013).

Table 4.13: Gender Related Improvement from Improved Water Supply

	Frequency	Percent
More time to engage in productive activities	16	12.9
Less stress on women	66	53.2
Reduction in the risk of being infected with W.R.D	4	3.2
All the above	18	14.5
None	20	16.1
Total	124	100.0

Source: Author’s Fieldwork

As evident from table 4.12 above, the main gender related benefits as revealed by the study include more time to engage in productive activities (13%), less stress on women (53%), reduction in the risk of being infected with WRDs (3.2%) and a combination of these factors (15%). Notwithstanding, a section of the respondents particularly those with their boreholes

broken down and those who still access the previous water supply for several factors do not see any of these benefits. With less stress time on women and more time for productive work, household incomes are likely to increase. This will be one of the ways of reducing or eradicating poverty thus ensuring development.

4.12 Improved Water Supply and General Living Conditions

This section explored the unquantifiable benefits of improved water supply in the lives of the people. This includes how the general environment in various communities has changed due to the new water supply system. Narrating his experience, an opinion leader explains “*the community’s general living conditions have improved because we have access to potable water supply as a basic need. Water is readily available for all purposes including the government school feeding program*” (Filed Interview 2013). There used to be cases of children drowning especially in wet seasons when the river overflows its banks. With the emergence of the new water supply system, there is no need for children to go to the river to fetch water hence eradication of deaths from drowning. Among the key indicators of poverty is lack of access to safe drinking water. In this direction, the communities’ access to safe drinking water acts to shift them a step away from the poverty line and thus improving their general living conditions. Additionally, there used to be water demand deficit in most communities in the district. Households had to live within the available water be it sufficient or not. Personal hygiene and sanitation was often sacrificed hence the outbreak of diseases like cholera and diarrhea. Ready access to potable water in sufficient quantities has therefore improved general hygiene and sanitation in the district. Above all, WRDs prevalence in the district has significantly reduced due to the new water supply system. But as has been discussed above, communities with their boreholes broken down are yet to experience these improvements in their lives. Table 4.13 below shows a cross-section of improvements in general living conditions after the provision of improved water supply.

Table 4.14 Improvements in Living Conditions

	Frequency	Percent
None	24	19.4
Reduction in water related mortality	3	2.4
Improved Health	37	29.8
Easy access to water as a basic need	52	41.9
Improved sanitation	8	6.5
Total	124	100.0

Source: Author's Field Work

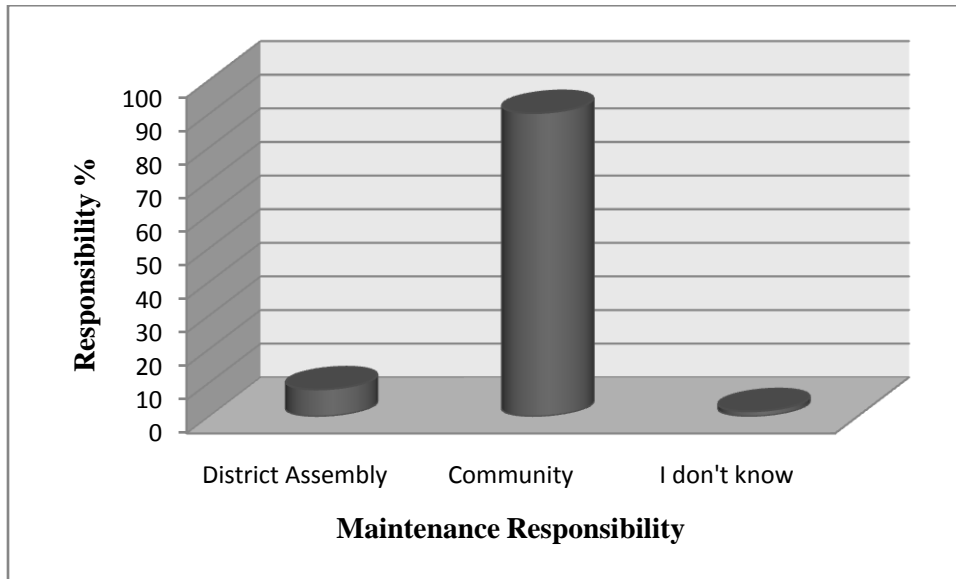
PART 6: Improved Rural Water Supply; the Sustainability Factor

The core issue with improved rural water supply is not its provision per say but the mechanisms to put in place to ensure its sustenance. Evidently, most rural communities lack access to improved water supply not because of absence of water facilities. In most cases, facilities are abandoned after breakdown because no mechanism is in place for repairs either by the government or the community. The study revealed that some of the facilities (pumps) are old and inefficient. According to Zehnder et al (2003:13) governments through local authorities have the responsibility of providing sufficient water of highest quality for the basic water requirements to its citizens. Citizens in developing countries do not have the capacity to provide water facilities on their own. The study revealed that almost all the boreholes in the district were provided by government effort with little or no community support. In this regard, communities are expected to also maintain water facilities so as to enjoy its benefits. Unfortunately however, these communities are sometimes not given the prerequisite skills or education to handle these facilities. The Atwima Mponua district equipped its communities in this regard. Whilst some communities have theirs working effectively, others have theirs almost none existent.

4.13 Community Participation

Participation has been accepted as a necessary strategy in making and implementing poverty alleviation programs. Involving beneficiaries has proved to lower costs, better target people's needs, incorporate local knowledge and ensure that benefits are equally distributed. It further creates grassroots capacity to undertake other development projects and to maintain benefits particularly in the case of physical infrastructure (Kleemeir 2000:930). Strengthening of local institutions and decentralization are mostly related to bringing power and responsibility down to the community (Esman&Uphoff, 1984 in Kleemeir 2000:930). This makes participation crucial for the sustainability of any project. Nonetheless, "it is not only the existence of public participation that is important, but also the extent and meaningfulness of this participation" (Tadesse et al 2006:7). One thing is having participation stipulated on paper and actually involving the people from water supply provision to its maintenance. Community participation may include an avenue for inclusion of people's views or financial commitment. The time span needed for project implementation might increase when effective participation is in place. However if long term sustainability of water supply systems is taken into consideration, then community participation must be ensured in all phases of water supply provision. An interview with officials of the District Assembly revealed that "*all water facilities in the District are community operated, managed and maintained*". The district after providing water facilities leave it in the hands of the community under "Community Ownership and Management (COM)". The system is sometimes fraught with problems which include lack of spare parts and Area mechanics. Fund mobilization is generally poor in some communities. Communities' response confirmed that water facilities are community maintained but how effective this is constitutes another issue.

Figure 4.15 Water Facility Maintenance Responsibility



Source: Author's Fieldwork

A little over 90% of the respondents agreed that the current water facilities are community owned and managed. The remaining percentage is either not involved in the mechanisms in place or thinks it is the district assembly that ensures its maintenance. Surprisingly, the study found some respondents (although only 1.6%) who had no idea of the actors responsible for the maintenance of the water they fetch. The effectiveness of community mechanisms determines the state of water facilities. Whilst some communities had all their boreholes working, others had 4 out of their 5 borehole broken down indicating the type of management system in place. Below is a cross-tabulation of communities and the state of their water facilities.

Table 4.14 Cross-tabulation of communities and the state of their water facilities

			Condition of Water facilities		Total
			All operational	Some broken down	
Name of Community	Abompe	Count	5	0	5
		% of Total	4.0%	.0%	4.0%
	Beposo	Count	1	18	19
		% of Total	.8%	14.5%	15.3%
	Bedabour	Count	30	6	36
		% of Total	24.2%	4.8%	29.0%
	KyenKyentaa	Count	12	0	12
		% of Total	9.7%	.0%	9.7%
	Kwame Dwaa	Count	15	1	16
		% of Total	12.1%	.8%	12.9%
	Mansaso	Count	14	0	14
		% of Total	11.3%	.0%	11.3%
	Anwiafutu	Count	14	8	22
		% of Total	11.3%	6.5%	17.7%
Total		Count	91	33	124
		% of Total	73.4%	26.6%	100.0%

Source: Author's Fieldwork

As can be seen from the table, some communities have all their boreholes working whilst others have some broken down. This has a direct relationship with the effectiveness and the kind of maintenance system in place. Communities like Kyenkyentaa, Mansaso and Kwame Dwaa have effective user collection fee system in place. This adds up to a committee set up especially for water facility management. Occasionally, the whole community meets with the committees for them to render accounts on the fees collected and work done. The opinion leader interviewed in Kwaame Dwaa narrates:

“A committee has been set up made up of three females and four males and they work effectively towards the sustenance of the water facilities. We collect water user fees monthly which the committee keeps at the bank. No one has access to this money except the whole community agrees. One of our boreholes broke down last year and it was repaired the next day. We quickly redrew money from our account and looked for a mechanic from Nyinahin, the district capital. Community members brought foodstuffs from their farms for the mechanic so the price was reduced for us” (Field Interview 2013).

The chief of Kwame Dwaa suggested this to the Mansaso community which had no maintenance mechanism in place. They accepted and now have a more effective system than Kwame Dwaa. As can be seen from the table, they have all their boreholes working effectively. Beposo is a typical community with no water maintenance system in place. According to the unit committee member interviewed,

“We used to have a committee in place until four of our boreholes broke down. No one knows what they did with the moneys collected so community members are not willing to pay any more. As a result, the whole community depends on one borehole which I know will get spoilt soon. We need government support for repairs or building of new ones” (Field Interview 2013).

This community sees water maintenance as something beyond community capacity and therefore calls for government help. Such a perception from the community impedes the sustainability of water facilities. It also limits the enthusiasm the district assembly has to provide new water facilities when the current facilities have broken down in a short while without any effort to repair. Evidence from other communities proves that community maintenance could be very effective so with a little government effort in this direction, water supply sustainability could be ensured. Below is a summary of mechanisms put in place by communities to ensure sustainable access to improved water supply:

Table 4.15 Mechanisms in Place by Communities Sustainable Water Supply Access

	Frequency	Percent
Collection of user fees	39	31.5
Setting up of committees	42	33.9
Communal monitoring of facilities	11	8.9
Setting up committees and collection of fees	28	22.6
All the above	4	3.2
Total	124	100.0

Source: Author's Fieldwork

4.14 Government-Community Synergy Relations; Evidence of Complementarity and Coproduction

According to Evans (1996:1123), since public agents and citizens have sufficiently different kinds of inputs that are equally necessary, they can produce more efficiently by combining their efforts than by either producing everything privately or everything publicly. The study confirms that sustainable access to improved water supply will not be feasible if the responsibility is left in the hands of only the government or only the community. Government-Community synergy lies at the heart of the sustainability process. In complementarity, there is a clear cut division of labor based on the contrasting properties of public and private institutions. Government therefore delivers certain distinct collective goods which complements the inputs provided by the private sector (Evans 1996:1120). In coproduction however, the inputs necessary in the development process are contributed by individuals who are not in the same organization. Both government and community take an active part in the water provision and sustenance process. This was seen in the water facilities provision in the district. About 40% of the respondents pointed out that water facilities were provided by both the government and community. An interview with one chief revealed that the community contributed 30% of the cost and the government, the remaining 70%. All the boreholes in the communities were working effectively because the people have their investments to protect. Communities that made no contributions at all did not show much commitment in maintenance. Drawing inferences from this scenario, if coproduction is adopted in water supply provision in all communities, sustainability could be ensured to some extent. Complementarity elements were also observed. According to the district assembly, *Community Water and Sanitation Committees (WATSAN Committees) are formed in all*

communities with potable water facilities and are responsible for day-to-day operation of their facilities (Field Interview 2013). WATSAN Committees are among the key water management mechanisms in the district. The committees are formed by the district assembly. Communities provide people to be trained by the District Assembly. Below is an overview of all water facility management mechanisms in the district according to the district assembly:

Table 4.16 Water Management Systems in the District According To the District Assembly

Management systems	Effectiveness
Formation of WATSAN committees	Very Good
Training of WATSAN committees	Excellent
Formation of Area Mechanics	Excellent
Procurement of Motor bikes for Area Mechanics	Excellent
Provision of Adequate Funds	Excellent

Source: Author's Field Work

Among these management systems, the one found to be present in the communities was the WATSAN Committees. The study revealed that this committee was absent in some communities. Where they existed, their activities were questionable. A respondent recounts: “would our boreholes be in its present condition if the WATSAN was working effectively?” (Field Interview 2013). Approximately 55% of the respondents did not know anything about WATSAN Committees, 17% knew little and only 27% knew much about their activities. If community members are not aware of these committees, how can they cooperate with them to ensure effective work? Mean while, WATSAN committees are expected to perform the functions below among other things according to the district assembly:

1. Organisation of Meetings of WATSAN Committee
2. Organisation of Meetings of WATSAN with the community
3. Preparation of Facility Management Plan
4. Signing of WATSAN Constitution
5. Community Self-Process Review
6. Preparation and Implementation of Hygiene and Sanitation Improvement Plan
7. Hygiene Education Sessions held
8. Promotion of hand washing with soap
9. Opening of Bank Account for O & M (GH¢70 per pump a year)
10. Preparation of Operation and Maintenance strategy

11. Recording of Financial Transactions (Income & Expenditure accounts)
12. Pumps operational
13. Preventive maintenance
14. Erosion Protection
15. Pump site cleanliness
16. Co-operation with Area Mechanics

It was evident from the study that most of these functions are hardly performed whilst those that are done left much to be desired. Only two of the six communities of the study had a bank account system in place for water facility maintenance. The remaining resorted to random money collection to solve the problems which community members said goes into individual pockets at the end of the day. They are therefore not motivated to pay again. Effective WATSAN work in certain communities means that the district assembly did their work in creating the committees and training members. After the formation and training of WATSAN members by the Assembly however, the community needs to educate its members on their activities and cooperate with them for the complementarity process to be complete. Communities with WATSAN Committees working effectively had all their water facilities working and community members paying their water user fees. From the discussions so far, government provision and community maintenance of water facilities is an effective way of ensuring sustainable access to improved water supply in rural communities. After water provision, government authorities must follow from a distance to ensure that water facilities are properly maintained. This section concludes with a summary of community perspective of the most appropriate ways of ensuring sustainability of improved water supply:

Table 4.17 Opinions on Sustainability

	Frequency	Percent
I don't know	6	4.8
Collection of User Fees for Early Repairs	23	18.5
Communal Effort	25	20.2
Government Effort	16	12.9
Community Effort and Government support	9	7.3
Proper operation and maintenance of water facilities	45	36.3
Total	124	100.0

Source: Author's Fieldwork

4.15 Rainwater Harvesting As a Sustainability Option

Rainwater harvesting could be a viable source of potable water considering the heavy rainfall in the district. Rainwater is currently harvested using traditional methods. The rainwater is channelled from rooftops into containers. Due to lack of adequate storage facilities, it has not yet been considered a viable source of water supply although households collect it in small quantities. Almost 82% of the 124 respondents agree to some extent that rainwater harvesting could serve as an improved water source. However, the remaining 18% does not agree. The reason being that rainwater is not potable enough. Due to recent change in climate, rainfall is intermittent. Their roofs get dusty after a period of no rainfall. They have to wait for it to rain for three to four times before rainwater could be collected. According to one respondent “*how can we use rainwater? You sometimes find lizard droppings and worms in it after collection*” (Field Interview 2013). In addition to intermittent rainfall is the fact that rainwater cannot be kept for a long time. The study revealed that when rainwater is kept for five days to one week, you find some tiny organisms in it which makes it unusable. But again, this has to do with the problem of storage. Some also do not see the need for storing rainwater when boreholes are readily available. But for those whose boreholes have broken down, rainwater harvesting could be an improved water source against all odds. The main rainwater storage systems identified were metal and rubber tanks (34.7%), buckets and rubber basins (53.2%), concrete tanks (1.6%) and a combination of tanks and basins (6.5%). The strong options available for making rainwater a

viable source of improved water supply are building a community concrete tank (7.3%) big tanks in individual homes (52.4%) and public education (0.8%). A section of the respondents (40%) still hold the view that this is impossible because of unreliable rainfall and the questionable quality of rain water.

4.16 Summary of Analysis of Findings

Research Question 1: To what degree has the water supply improved significantly during the last seven years?

The main water sources in the District before the advent of the Rural Water Supply and Sanitation Initiative (RWSSI) in 2005 were hand-dug wells, boreholes, River Offin and other streams. Boreholes were limited to a few bigger communities in the district. Only Nyinahin, the district capital and Mpasatia have access to pipe borne water. About 91% of the respondents interviewed revealed that their main water source was River Offin, the principal river in the district. Others resorted to dug-outs and smaller streams which dried up in dry seasons. The surface water sources were not potable but the people did not have any alternative. The open nature of surface water exposed it to contaminants from illegal fishing in dry seasons, mining and waste deposition by communities upstream. As at June 2012, almost every community in the district has at least a borehole. This water supply source is protected, less susceptible to contamination and therefore potable for human consumption. The Atwima Mponua District with an estimated population of 143,303 now have potable water coverage of about 85.4% from 45.2% before 2005 (Atwima Mponua District Assembly). Interviews with respondents pointed out that 76% of the population now access water from boreholes, 2.4% from hand-dug wells and 16% from both boreholes and hand-dug wells. This means that about 95% of respondents now have access to improved water supply as against 7% about seven years ago.

Research Question 2: How accessible is improved water supply to the district?

Before the provision of boreholes, the main water source, River Offin, was close to some communities. It therefore required minimum effort for people to access. Some households were located about 100m to 500m from the River. Consequentially, about 65% of respondents interviewed had their water supply “close” to them. In this regard, the only problem with water

accessibility was quality. Communities like Kyenkyentaa, Kwame Dwaa and Mansaso however, had to travel about 1.5km to 2km to access River Offin. This was strenuous for women and children who are particularly tasked to provide water for the household. With about 360 boreholes and 23 Hand-Dug Wells constructed under the Rural Water and Sanitation Programme (RWSP - IV) and the Rural Water and Sanitation Intervention (RWSSI), access to improved water supply has considerably improved. Using the Ghana Community Water and Sanitation Agency calculation of one borehole to 300 people, communities like Kwame Dwaa, Bedabour, KyenKentaa and Mansaso have water supply surplus. Boreholes are very close to households and require minimum effort to access. Distance to improved water access points has reduced from 2km to 50m to most households. The current access to potable water supply is however impeded by poor management practices which lead to frequent breakdown of boreholes. Also communities are fast expanding so new inhabitants who have to walk a long distance to access boreholes would rather access streams close by. Interviews further revealed that despite the current access to improved water supply, there are factors that are likely to push people to surface water. This included congestion at the new water source, the labor intensive nature of borehole operation, proximity of surface water to farms, collection of water user fees, time spent accessing new water source and surface water as a preferred choice. About 47% of respondents however maintain that nothing can push them to their previous water supply source. Government must collaborate with communities to repair broken down boreholes and if possible drill new ones for the expanding population. Also, communities must be educated on proper operation of water facilities and the need to put in place effective management mechanisms.

Research Question 3: What factors account for the present conditions of water supply in the district?

The Rural Water and Sanitation Programme (RWSP - IV) and the Rural Water and Sanitation Intervention (RWSSI) are the results of the commitment on the Part of Government of Ghana in the achievement of the MDGs. The initiatives received funding from the African Development Bank. Among other things, the initiative was committed to increase access to potable water supply to help reduce the incidence of water related diseases, improve upon the existing water facilities, train and increase the number of Area Mechanics for water facilities repairs and form

and train WATSAN Committees for water facilities maintenance. Other initiatives responsible for the current water supply facilities are Community Based Rural Development Project (CBRDP), Government of Ghana (GOG) initiatives and The District Owned Initiative. The Atwima Mponua District Assembly was the main actor responsible for the implementation of the initiatives. This was done with some community involvement. Interviews and observations revealed that, where the communities were actively involved in implementation, water facilities were well managed. These communities therefore enjoyed the benefits of improved water supply. On the contrary, the benefits of improved water supply did not last in communities that renege on their commitment during the projects implementation. In all, Government of Ghana, District Assembly and other donor agencies are responsible for water supply program initiation and implementation. The conditions of the facilities however largely depend on community inhabitants. This explains why some communities have all their boreholes functioning whilst others have only one out of five functioning.

Research Question 4: To what extent has improved rural water supply reduced the incidence of water related diseases in the district?

Water related diseases took about 50% of the health burden in the Atwima Mponua District before the provision of improved water supply from 2005 to 2012 (District Health Directorate). The prevalent water related diseases in the district include diarrhea, worm infestation, malaria, buruli ulcer and bilharzias. These diseases affected communities in varying degrees. While some diseases had very high prevalence rate, others were very low. The main attributive factor for the diseases was their main previous water supply, River Offin. Diarrhea, according to the interview with the District Hospital had a high prevalence rate before the provision of improved water supply. This was confirmed by Key informants. At the extreme case, diarrhea claimed some lives. Almost 90% of the community respondents interviewed admitted the existence of diarrhea before improved water supply, although at varying degrees. The situation has however changed because more than half of the respondents accept that diarrhea prevalence has reduced. Guinea worm and other intestinal worms have a direct link with water ingestion. The district hospital recorded 5,750 cases representing 11.2% of the district health burden before 2005. As at 2012, it had reduced to 6.2%. Interviews with respondents revealed that the existence of worm infestation

ranged from high (14%), average (15%) to low (54%). Although the incidence of worm infestation has reduced, 36% of interviews conducted shows that the prevalence rate is still the same. Malaria is the first among the diseases that affects the district. Previous dug-outs for water provided breeding grounds for mosquitoes, the causative agent of malaria. Even with the absence of these dug-outs due to boreholes, it appears there are still avenues for mosquito breeding. Whereas more than half of respondents admitted high and very high prevalence rate of malaria, only 30% has seen a significant reduction after the provision of improved water supply. The remaining 70% either has not seen any significant reduction or assumes it has the same prevalence rate. Buruli ulcer had a high to average prevalence rate in the district before improved water supply. Its impact on the people was enormous because there was little knowledge about the disease. The provision of water facilities has significantly reduced buruli ulcer incidence in the district. However, there are still isolated cases. Interviews revealed a high prevalence rate of bilharzias before the provision of boreholes. Bilharzias mostly affected children and young adults who swam in River Offin. With the provision of boreholes, children no longer go to the stream to fetch water, let alone get the opportunity to swim and contact the disease. About 65% of interviews pointed out a significant reduction in bilharzias but 20% claim the situation has not changed. The discussions so far proves that the provision of improved water supply in the district as at now has not been able to significantly reduce the incidence of water related diseases. This is mainly due to poor management systems of water facilities. Some boreholes broke down few years after provision and got abandoned because there was no money for repairs. A Community like Beposo has only one of its five boreholes working. Due to this, people still rely on previous water supply sources, hence no significant reduction in the diseases they were contracting from such sources. Kyenkyentaa and Mansaso have all their boreholes in place and have therefore experienced a significant reduction in WRDs. The key issue therefore is sustainable management of water facilities to enjoy lasting benefits.

Research Question 5: How has improved water supply affected the general wellbeing of the people?

Improved water supply has accrued economic and gender related improvements in the Atwima Mponua District. In addition, the general living conditions has also improved. The provision of

boreholes has had a direct effect on economic activities. Frequent illness from WRDS excused people from active engagement in productive activities. Besides the loss of productive hours, moneys used for disease treatment acted as a drain on family incomes. Women who operated as food vendors, palm oil processors and “iced water” sellers have seen improvement in their activities. Distance traveled to access water for various activities has reduced from 1.5km in communities like Kyenkyentaa, Mansaso and Kwame Dwaa to 50m. Palm oil processors for instance are able to process as much oil as possible because of the ready availability of water. Various economic related impacts identified include increase in household income, occupation enhancement, source of employment, community development and more time for productive activities. Women spent a considerable amount of time in the provision of household water. This left little or no time for productive activities. Female children who assist their mothers in household water provision put their school at risk. Interviews revealed that the provision of boreholes has provided more time for females to engage in productive activities, reduced their stress and the risk of being infected with water related diseases. The general environment of communities has changed with the presence of improved water supply. This includes reduction in water related mortality, improved health, easy access to water as a basic need and improved sanitation. However, about 19% of respondents who have their boreholes broken down have not seen any such improvements.

Research Question 6: What are the management measures in place to ensure sustainable improved water supply?

The core issue with improved rural water supply is not its provision per say but the mechanisms to put in place to ensure its sustainability. This explains why most rural communities lack access to improved water supply not because of absence of water facilities but lack of effective mechanisms to repair boreholes after breakdown. All water facilities in the district are community owned, operated, managed and maintained. After the provision of boreholes, maintenance responsibilities are left in the hands of communities without government supervision. The district assembly claimed to have formed and trained WATSAN committees in almost all the communities for water facility maintenance. Conversely, 55% of respondents did not know anything about these committees let alone cooperate with them. Some communities however have their WATSAN committees in place that works effectively. These communities

have all their boreholes operational whereas those without them have some of their boreholes abandoned after breakdown. Some respondents recounted that moneys collected by committee members were misappropriated and that was a disincentive to further monetary contributions for maintenance. On the other hand, communities like KyenKyentaa, Mansaso and Kwame Dwaa have a bank account into which they put their money for borehole repairs. On the whole, water management mechanisms in the district include collection of user fees, setting up of committees, communal monitoring of facilities and a combination of these mechanisms. Government-community synergy is evident in the provision and management of water facilities. The process will however be strengthened if government does not completely leave water facilities in the hands of communities, but follows up from a distance. This will urge communities to take proper care of facilities and enjoy lasting benefits. The high rainfall in the district makes rainwater harvesting a viable source of sustainable water supply. However, the unreliable nature of rainfall coupled with lack of water storage facilities makes the concept quite problematic.

4.17 Validity Discussion on Findings

According to Bryman (2008:32), validity is concerned with the integrity of the findings and conclusions that are generated from a research. Among others, there is measurement validity, internal and external validity. The study critically crafted questions to specifically measure concepts. This was made possible by the quantitative research strategy used which made objectivity possible. It is probable that respondents might have answered questions to suit the researcher. But much care was taken to get the information on the extent of impact of improved water supply on WRDs for instance. The study also brought out the causality between unsafe water supply sources and WRDs. Both qualitative and quantitative research strategy was used to confirm what is in literature that water affects all facets of life. While improved water supply uplifts general wellbeing, unsafe water sources deteriorate the quality of lives people live. The study employed the case study research design with makes generalization difficult. However, the concepts used (water and health) are universal. The study results could be generalized for rural Ghana because rural communities are homogenous. Notwithstanding, the extent to which improved water supply has reduced water related diseases might differ from place to place. This is evident from the different communities explored.

Chapter 5

Conclusion and Recommendations

This chapter outlines the conclusion and recommendations of the thesis. The deductions made from empirical findings and literature review served as the basis for conclusions made. Based on the discussions and conclusion, recommendations and areas for further research are proposed.

5.1 Conclusion

As mentioned in the Introduction, water is irreplaceable in all facets of development. The unavailability or deterioration in the quality of water supply almost puts life on hold. Despite this fact, a section of the world's population lives without access to improved water supply. About 91% of the respondents interviewed did not have access to improved water supply before the RWSSI. Lack of adequate capacity and financing are the main impediments to the provision of improved water supply. This explains the reason why the global burden of poor access to safe water falls primarily on the poorest of the poor. In the absence of improved water supply, people resort to unsafe water supply sources with its effects including increase in water related morbidity, poor general wellbeing, reduction in family income and productive hours. Easy access to improved water supply could therefore be said to have a direct relationship with poverty and its reduction.

The most crucial of the effects of water is on human health. This is because, water is fundamental for life and health. Water related diseases resulting from the use of unsafe water constitute a great percentage of the global health burden. A considerable number of people die each year due to water related diseases. About 1.8 million people die every year from diarrheal diseases alone whilst 3,900 children die every day from water related diseases (WHO 2004 in WWC 2012). Water related diseases have many repercussions. A country cannot develop with a sick population, productive hours are reduced because people are sick or taking care of the sick, family income is reduced and people are further pushed into poverty. The critical relationship between water availability and human health makes the provision of improved water supply very urgent.

Good government policies, community initiatives and a synergy between the two are the most effective ways of providing improved water supply. In most cases however, communities see the provision of water supply as the duty of government. Government on the other hand in their provision of improved water supply hardly involves the people the facilities are intended for. Communities therefore do not feel obliged to maintain water facilities. This explains the unsustainable nature of most water supply projects. A healthy collaboration between government and communities is therefore the effective way of ensuring sustainable access to improved water supply. Per the research data analyzed, governments' capacity to provide improved water supply was inadequate until the intervention of the African Development Bank which ensured the implementation of the RWSSI.

Reverting to the introduction, one of the questions asked was how improved water supply has affected the incidence of water related diseases. The research has found a clear answer to this. Water related diseases constituted a greater percentage (about 50%) of the district health burden. However, improved water supply has significantly reduced some WRDs. The district nevertheless could not be said to have completely eradicated water related diseases. It was evident that government-community collaborations ensure sustainable access to improved water supply. Communities that were involved in the provision of the water supply facilities have effective management systems in place. Such communities have all their boreholes operational. Nonetheless, there are communities who do not know the actors who provided their water facilities let alone their involvement in the process. In these communities, water facilities are abandoned after breakdown because no management mechanisms are in place. This also explains why water related diseases still exist in some communities in the district while water facilities have been provided.

5.2 Recommendations and Areas for Further Study

Provision must be made for the drilling of more boreholes due to the rapid expansion of villages. Although communities do not have the capacity to do this, they should be actively involved by the local authority so that they will be committed to its maintenance. Also, there are still communities in the Atwima Mponua District without access to improved water supply. The District Assembly together with the people must put mechanisms in place to water facilities and reduce the repercussions of accessing unsafe water sources.

Communities must be educated on proper management of water facilities. Most boreholes experience frequent breakdown due to improper operation by children and some adults. There is also the need for attitudinal change. The people must feel responsible for the maintenance of water facilities. It was also observed that some people preferred surface water even in the presence of boreholes. Such people must be sensitized on the need to access water from protected sources. This will help reduce the incidence of water related diseases.

The reduction in WRDs is not significant in most communities. This is due to factors like frequent breakdown of water facilities, collection of fees, nearness to farm and time spent in accessing safe water source among others. Community inhabitants must change their maintenance culture and their attitude in general towards the new water facilities to ensure significant reduction or total eradication of WRDs in the district.

The study revealed that improved water supply has significant impact on women in general. However, it was not the main focus of the study and therefore was not explored in detail. Further research could be carried out in this direction. Also, rainwater harvesting is a technique that could be explored for improved water supply in the district and other rural areas. The main obstacle appears to be lack of storage facilities. This area could be further explored by NGOs and the district assembly to enhance improved water access. The study discovered that water levels in boreholes drop during dry seasons while rainfall patterns have also changed. This could be attributed to climate change. Therefore further study could be carried out of the impact of climate change on rural water supply.

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Appendices

Appendix 1:

Structured Interview for Local Communities for Quantitative Assessment

A. Demographics

1. Gender of household head

(a) Male [] (b) Female []

2. Age

(a) 20 – 30 years []

(b) 31 – 40 years []

(c) 41 – 50 years []

(d) 51 – 60 years []

(e) 60 years and above []

3. Educational status

(a) Never been to school []

(b) Primary School []

(c) Junior high school/Middle school []

(d) Senior High School/Secondary school []

(e) Technical/Vocational []

(f) University/Polytechnic []

(g) Other, please specify.....

4. Marital Status

(a) Single []

(b) Married []

(c) Divorced []

(d) Widow/Widower []

5. Number of persons in household/family.....

6. Occupation

(a) Farmer

(b) Fisherman

- (c) Trader
- (d) Not employed

7. Duration of Stay in the community

- Since Birth
- 1-5
- 6-10
- 11-15
- 16 -20
- 25 – Above

B. Previous state of water supply

8. What was your source of water supply?

- (a) Surface water[]
- (b) Borehole[]
- (c) Hand dug well[]
- (d) Others (please specify).....

9. How accessible was it?

- (a) Very close[]
- (b) Close[]
- (c) Average[]
- (d) Far[]
- (e) Very far[]

10. What was the water supply rate?

- (a) Constant[]
- (b) Intermittent []
- (c) Unreliable[]
- (d) Others (please specify).....

11. How potable was the available water?

- (a) Very good []
- (b) Satisfactory []
- (c) Very poor []
- (d) Poor []

C. Current water supply conditions

12. What is your present water supply source?

- (a) Surface water[]
- (b) Borehole[]
- (c) Hand dug well[]
- (d) Others (please specify).....

13. What was the source of funding for the current water facilities?

- (a) Government[]
- (b) Community[]
- (c) Government and community effort[]
- (d) NGOs[]
- (e) Others (please specify).....

14. How accessible is the current water supply?

- (a) Very close[]
- (b) Close[]
- (c) Average[]
- (d) Far[]
- (e) Very far[]

15. What factors are likely to push you to your previous water supply source?

- (a) Congestion at the new source of water supply[]
- (b) Time spent in accessing new water supply[]
- (c) Labor intensive[]
- (d) Frequent breakdown[]
- (e) Others (please specify).....

16. What is the quality of the current water supply as compared to the previous one?

- (a) Very good []
- (b) Satisfactory []
- (c) Very poor []
- (d) Poor []

17. What is the current water supply rate?

- (a) Constant[]
- (b) Intermittent[]
- (c) Unreliable[]
- (d) Others (please specify).....

D. Relationship between Improved Water Supply and Health

18. Which water related diseases were prevalent in this community?

- (a) Bilharzia[]
- (b) Diarrhoea[]
- (c) Worm infestation[]

- (d) BuruliUlcer[]
- (e) Malaria[]
- (f) Others (please specify)

19. Which of these diseases are still prevalent? (Please answer according to its degree of occurrence)

.....

20. How often did this family experience water related diseases before the current water supply facilities?

- (a) Always []
- (b) Most times []
- (b) Sometimes []
- (c) Never []

21 Would you say the situation has changed with the emergence of new water supply?

- (a) Yes[]
- (b) No []

22. What would you say are the effects of water related diseases?

- (d) Drain of family income[]
- (b) Reduction of productive hours[]
- (c) Death as an extreme case[]
- (d) Others (please specify).....

23. How would you describe the prevalence of diarrhoea in this community about 7 years ago?

- (a) Very High
- (b) High
- (c) average
- (d) Low
- (e) Verylow

24. How is the prevalence of diarrhoea now?

- (a) Significantlyreduced
- (b) Reducedbut not significant
- (c) Same prevalence rate
- (d) Increase in itsprevalence

25. What was the degree of prevalence of worm infestation in this community about 7 years back?

- (a) Very High
- (b) High
- (c) average
- (d) Low
- (e) Verylow

26. How would you describe the incidence of worm infestation in this community now?
- (a) Significantly reduced
 - (b) Reduced but not significant
 - (c) Same prevalence rate
 - (d) Increase in its prevalence
27. Malaria is the first among the top ten diseases in this district. Describe its prevalence in this community about 7 years ago.
- (a) Very High
 - (b) High
 - (c) average
 - (d) Low
 - (e) Very low
28. How would you describe the change in its incidence?
- (a) Significantly reduced
 - (b) Reduced but not significant
 - (c) Same prevalence rate
 - (d) Increase in its prevalence
29. How was the incidence of Buruli ulcer in this community about 7 years ago?
- (a) Very High
 - (b) High
 - (c) average
 - (d) Low
 - (e) Very low
30. What has happened to the incidence of Buruli Ulcer now?
- (a) Significantly reduced
 - (b) Reduced but not significant
 - (c) Same prevalence rate
 - (d) Increase in its prevalence
31. How would you describe the prevalence of bilharzia in this community about 7 years ago?
- (a) Very High
 - (b) High
 - (c) average
 - (d) Low
 - (e) Very low
32. How is the prevalence of bilharzia now?
- (a) Significantly reduced
 - (b) Reduced but not significant
 - (c) Same prevalence rate
 - (d) Increase in its prevalence

E. Improved Water Supply and General Wellbeing

33. What economic related improvements can you attribute to the current water supply situation?

.....
.....
.....
.....

34. What gender related improvements could be attributed to improved water supply?

- (a) More time to engage in productive activities[]
- (b) Less stress on women[]
- (c) Reduction in the risk of being infected with water related diseases[]
- (d) Others (please specify).....

35. How have the general living conditions in this community improved due to the current water supply conditions?

.....
.....
.....
.....

F. Management Measures in Place to Ensure Sustainability

36. Who is responsible for the maintenance of water facilities?

- (a) District Assembly[]
- (b) Community[]
- (c) District assembly and community[]
- (d) Others (please specify).....

37. What is the condition of the water facilities available?

- (a) All operational[]
- (b) Some broken down[]
- (c) All broken-down[]
- (d) Others (please specify).....

38. What has the community put in place to maintain water facilities?

- (a) Collection of user fees[]
- (b) Setting up of committees[]
- (c) Communal monitoring of facilities[]
- (d) Others (please specify).....

39. What do you know about Community Water and Sanitation Committees (WATSAN)?

- (a) Nothing[]
- (b) Little[]

- (c) Much[]
- (d) Very much[]

40. If WATSAN is in your community, how do you find their work?

- (a) Effective []
- (b) Satisfactory[]
- (d) Poor[]
- (e) Very poor[]

41. If WATSAN is absent in your community, what might be the cause?

- (a) No knowledge of WATSAN[]
- (b) It is not necessary[]
- (c) There is another mechanism in place[]
- (d) Others (please specify).....

42. What do you think should be put in place to make improved water supply sustainable in this community?

.....
.....
.....

G. Rainwater harvesting as a sustainability tool

43. Rainwater harvesting could be a viable source of improved water supply.

- (a) Agree []
- (b) Strongly agree []
- (c) Disagree []
- (d) Strongly disagree []

44. What method do you use to harvest rainwater?

- (a) Metal tanks []
- (b) Buckets and rubber basins []
- (c) Concrete tanks []
- (d) Others (please specify).....

45. What could be done to make rainwater harvesting viable source of improved water supply?

- (a) Build a community concrete tank []
- (b) Big tanks in individual homes []
- (c) Impossible because of unreliable rainfall patterns []
- (d) Others (Please specify).....

Appendix 2

Qualitative Interview Guide for Officials of the Atwima Mponua District Hospital

Data Collection Technique: Semi-Structure Interview

Sampling: Purposive

Name of Interviewer:.....
(Compulsory)

Name of Interviewee:.....
(Optional)

Date: **Interview Code:**.....

Duration of work in the Hospital

- 1-5
- 6-10
- 15
- 16 -Above

Position in Hospital:.....

Interview Questions

1. What are the most common diseases reported by the people in the district?
2. How frequent are these diseases reported?
3. What are the causes of these diseases?
4. Please describe the health conditions in the district about 7 years ago.
5. Would you say the situation has changed in the last 7 years?
6. Please explain how and why?
7. Which water related diseases are reported to this hospital?

8. What has been the trend of water related diseases from seven years downward?
9. Would you attribute any change in the trend of water related diseases to improved water supply in the district?
10. Please explain why
11. To what extent has improved rural water supply reduced the incidence of water related diseases in the district?
12. What has been the impact of water related diseases in the district (considering the cases reported to this hospital)?
13. Has there been any significant reduction in the water related diseases cases reported to this hospital?
14. Please explain your answer.
15. What do you think could be done to curb the incidence of water related diseases in the district?

Appendix 3

Qualitative Interview Guide for Officials of the Atwima Mponua District Assembly

Data Collection Technique: Semi-Structure Interview

Sampling: Purposive

Name of Interviewer:.....
(Compulsory)

Name of Interviewee:.....
(Optional)

Date: **Interview Code:**.....

Duration of work in the Assembly

- 1-5
- 6-10
- 15
- 16 -Above

Position in the Assembly:.....

Interview Questions

1. Please describe the water supply conditions of the district before the advent of the Rural Water Supply & Sanitation Initiative (RWSSI) in 2005.
2. What other water supply programs have been implemented by this district?
3. Who was responsible for the initiation, implementation and funding of these programs?
4. How accessible is improved water supply to the district?
5. What was the objective of the provision of water supply facilities in the district?
6. Has these objectives been achieved and why?

7. Describe the health conditions in the district before and after the implementation of the Rural Water Supply & Sanitation Initiative (RWSSI)
8. What are the specific health related improvements that could be attributed to the provision of water supply facilities?
9. What other improvements in the lives of the people could be attributed to the current water supply provision?
10. Who is responsible for the management of the water facilities provided?
11. What management systems has the Assembly put in place to ensure the sustainability of improved water supply in the district?
12. How effective are they?
13. What are the roles of WATSAN and are they present in all communities?
- 14a. Do you see collaboration between the district and the community as an effective way of providing and maintaining water facilities?
- 14b. Please explain why?
15. Are there communities in the district without access to improved water supply?
16. What is being done to change the situation?

Appendix 4

Qualitative Interview Guide for the Chiefs and Key Informants in Communities

Data Collection Technique: Semi-Structure Interview

Sampling: Purposive

Name of Interviewer:.....
(Compulsory)

Name of Interviewee:.....
(Optional)

Date: **Interview Code:**..... **Name of Community:**.....

Demographics

1. Gender

- Male
- Female
- 26-35
- 46-55
- 56-Above

2. Age

- Below 15 years
- 16-25
- 36-45
- Any other (please, specify).....

3. Marital status

- Married
- Single
- Divorce
- Separated

4. Dependents

- None
- Yes, there are

5. If yes, please specify the number of dependents

6. Duration of Stay in the community

- Since Birth
- 1-5
- 6-10

7. Occupation

- Farmer
- Fishermen
- Traders

- 11-15
- 16 -20
- 25 – Above

Not Employed

8. Educational status

Religion, denomination.....

- Never been to school
- Primary School
- Junior high school/Middle school
- Senior High School/Secondary school
- Technical/Vocational

.....

1. What was your communities' source of water supply about 7 years ago?
2. How safe was the water supply?
3. How accessible were these sources of water supply?
4. Was it available all year round?
5. Would you say these water supply conditions affected the health of the community?
5b. How?
6. Has your water supply source been improved?
7. Who was responsible for this improvement?
8. How accessible and available are the current water supply sources?
9. Are there any factors that drive the people to the previous water sources?
Please explain your answer.
10. Is this community satisfied with the water facilities available?
10b. why?
11. What water related diseases were prevalent in this community before the current water supply system?
11b. Explain its degree and frequency.
12. What were the effects of these water related diseases on the community?
13. Has the current water supply sources reduced the incidence of water related diseases?
13b. Please explain how
14. Can you attribute any economic related improvement to the current water supply system?
14b. Please explain your answer.

15. What has been the impact of the current water supply on the women in this community?
16. How have the general living conditions in this community improved due to the current water supply conditions?
17. Who is responsible for the provision and management of the water facilities in this community?
18. Please describe the conditions of the water facilities in this community
19. What are the management mechanisms in place to ensure the sustainability of water facilities?
20. How effective are they?
21. Does this community know about WATSAN?
 - 21a. If yes do you have one in place?
 - 21b. Are they operating effectively?
22. What do you think are the most effective ways of providing water facilities?
23. How can water facilities be maintained to ensure sustainable access to improved water supply?