Journal of Sustainable Development in Africa (Volume 11, No.1, 2009)

ISSN: 1520-5509

Clarion University of Pennsylvania, Clarion, Pennsylvania

ACCESS TO SAFE DRINKING WATER BY RURAL COMMUNITIES IN ZIMBABWE: A CASE OF MUNDENDA VILLAGE IN MUTASA DISTRICT OF MANICALAND PROVINCE

By

Manyanhaire, Itai Offat and Taneal Kamuzungu

Geography and Environmental Studies, Zimbabwe Open University

ABSTRACT

Access to water is as a basic human right that is threatened by increasing water consumption patterns in the communal areas of Zimbabwe. To understand the realities of water and sanitation at a micro scale, a case study of access to safe drinking water by rural households in Mundenda Village of Mutasa District in Zimbabwe was carried out between August 2007 and March 2008. Data were collected using a pretested questionnaire, key informant interviews, and field observations triangulated with secondary data sources. The Villagers had access to one communally owned protected borehole with an average daily yield of 1400 liters during the greater part of the summer season and 600 liters during the dry season. Villagers traveled long distances to water points spending on average 26 minutes per trip. The local authorities have to embark on a more inclusive participatory approach in the provision of safe drinking water and sanitation for the community.

Key words: safe drinking water, access, rural community, Zimbabwe

INTRODUCTION

The world faces severe and growing challenges to sustain water quality and to meet the rapidly growing demand for water resources, particularly among rural communities in Africa and Zimbabwe. This is despite the efforts (through the Integrated Rural Water Supply and Sanitation Programme) by the Zimbabwe Government and the donor community to improve the availability of safe drinking water to rural communities as an important policy matter since the 1980s. With increasing population water demand in Africa and Zimbabwe continue to rise and present challenges to the supply of water to rural communities. Critical determinants to this scenario include distance to the water point, polluted water sources, perennial droughts, depleted ground water sources, and poorly formulated water and sanitation policies. Given this scenario, it was imperative that a deeper understanding of the dynamics of access to water in the rural environment were explored with the view to influence policy. To achieve this, the paper examines the sources of water, access to water by households, constraints to the provision of safe drinking water, and the related environmental health implications of unsafe drinking water. Micro scale studies of this nature are critical in identifying environmental health risks associated with the continued limited access to safe drinking water in the rural areas of Zimbabwe. This was done on the assumption that the rural water provision programme has not met the desired targets of safe and readily accessible water to rural households.

LITERATURE REVIEW

Access to Water and Consumption Patterns among Rural Communities

Access to water entails being within safe physical reach, being affordable, accessible in law and in fact information on water issues being provided (UN, 2003). Reasonable access, thus, is the availability of at least 20 liters of water per person per day from a source within one kilometer of the homestead (WHO, needs date). Improving access to water has been the thrust of most governments, UN agencies, and many different organizations but these have failed to satisfy demand in the shortest time. The water supply and sanitation coverage for Africa remains the lowest at 62% and 60% respectively (WHO/UNICEF/WSSCC, 2000). This contrasts the coverage in Zimbabwe, which has declined to 30% in the last eight years owing to a host of factors, including destruction of infrastructure by Cyclone Eline, frequent droughts, and financial challenges. Thus, more than 75% of Zimbabwe's population of 12.5 million people continues to live under water stressed conditions in most rural areas.

Access to water is a basic human right that is threatened by increasing consumption patterns (Seckler, Molden, and Backer, 1998). Water scarcity means insufficient quantity and quality; its supply in communal areas is determined by population size, frequent droughts, lack of finances and planning, geophysical reality, climate change, excessive use, and pollution. Global consumption is doubling every 20 years and more than one billion people have limited access to fresh drinking water (Bhatia, Gestti, and Wimpenny, 1996; Falkenmark and Widstrand, 1992). In Sub Saharan Africa, 51% of the people lacked access to safe supply of water and 41% lacked adequate sanitation, whilst 14 countries were already experiencing water stress and another 11 countries were expected to join them by 2025 (Adams, 1999). Malawi and South Africa were projected to have absolute water shortages (availability of 1,000 m^3 of fresh water per year or less), while Lesotho and Zimbabwe will be stressed (1,000 m^3 – 17,000 m^3 of fresh water per year); Angola, Botswana, Zambia, and Swaziland are likely to experience water quality and availability problems in the dry season (SADC/IUCN/SARDC, 2002; Tevera, 2004)**.** Thus, the world faces daunting challenges towards the provision of water and sanitation where countries like Mozambique less than half of the population has latrines (Stockholm Water Front, 2006). This requires more than the usual attention for sanity to prevail.

It is estimated that 43% of rural Kenyans had either a household connection to water or had reasonable access to improved water sources in 2000 (WHO/UNICEF, 2003). Women pay the heaviest price for poor water supply and sanitation (WHO, 2000) as they are forced to walk long distances to fetch water. Small-scale water service providers, such as community-based organizations and independent private providers are being increasingly recognized as significant providers of water services in Africa. Collectively, they provide services to over 10% of urban and 30% of rural households in Kenya - accounting for over 30% of sector spending (Harvey and Reed, 2004). Access to finance and credit facilities is, however, severely restricted to such small-scale providers. As they have the potential to save, borrow, and invest for better services, sector policies should provide an enabling environment to foster such initiatives. Lack of funds, training on the operation and maintenance of boreholes, dwindling donor support for borehole projects and vandalism were some of the major challenges facing people in rural areas (*ibid*).

The amount of water that people need for a healthy life varies greatly between different peoples, between times of the year, days of the week, and particular circumstances. Nomadic people displaced in

Somaliland in 1992 had long standing water use habits based on just 2-3 liters per person per day, whereas Kurdish refugees in Northern Iraq had been used to at least 100 liters per person per day (Adams, 1999). Providing water for animals may also be essential for health. If it is not provided, people will consume less themselves or their animals will not thrive, making their livelihoods suffer. If there's inadequate provision for animals, there may be conflict over the use of water sources. Governments in developing countries have often subsidized water supplies to achieve social and health benefits for the low-income rural households.

The lack of reliable and good quality water sources is one of the principal constraints to development. For example, in South East Zimbabwe, surveys showed that 32 percent of the people relied on relatively unsafe water from unprotected wells, rivers, streams, and dams and that 73 percent of people walked at least 500 meters to their nearest sources of water (ZEWSP, 2006). Due to the scarcity of water and infrastructure in many countries in the region of Africa, women (particularly those in rural areas) are forced to walk long distances to fetch water. The risk of contamination is present during the transport of water from the source to the home and storage, but there is too little data to relate this risk to service level or water supply interventions. Increased supply may reduce the risk of contamination during transportation and hand washing is less common when a water source is greater than one kilometre from the home, but more frequent when the water is more accessible.

Time and energy spent collecting water is also an important factor in providing more water for increased hygiene practices; distance from the water source is a determinant for quality water supply. Water needs to be available when required, and those who travel longer distances to the water point tend to use less and it negatively impacts consumption and hygiene practices. At least 40 liters of water should be available at less than 1.6 kilometers for every household and accessed within a maximum 30 minute walk time carrying three buckets one way (UNICEF, 1999). Collecting water (an activity mostly conducted by women) requires them to walk to the source, wait in the queue, collect the water, and then carry it back. In Zimbabwe, the mean water collection trip with a heavy load on the head is estimated to be 1.4 kilometers in the wet season and 2 kilometers in the dry season (National Master Plan). In drought years, it is possible for women in the more marginal areas to travel up to 5 or 6 kilometers to fetch water, amounting to 40% of their daily untraditional intake traveling to collect water (World Bank, 1992). If the household has five members, it would require them to transport 200 liters of water daily.

Manzvire village in Chipinge District of Zimbabwe has a population of just over 5,500 with 514 households. About 290 households have access to individual toilets (Ventilated Improved Pit latrines) and 180 have access to pit latrines. At least 45 households were said to have zero access to any form of decent sanitation but were allowed temporary access to their neighbors' facilities. There is no surface water in this village, with the closest source the Save River, approximately 15 kilometers away. People use boreholes and shallow wells as water supply sources. The village has 10 bore-holes, with at least eight reported to be functional. HIV/AIDS and rural/urban migration contribute to at least 80 percent of the households being female or orphan-headed (Katsi, 2006).

In Domboshava, a rural area in Zimbabwe, water consumption per average household during summer, winter, and autumn was estimated at 170 liters, 150 liters, and 124 liters per day, respectively (Morgan, 1990; Morgan, 1992). When determining the value of clean water for domestic use, the location and convenience is a significant factor and is directly proportional to the distance traveled. For example, distances of several kilometers, the average consumption rate was 2-4 liters per day, up to a kilometer 4-8 liters per day, 10-20 liters for a water point next to the house, 60-100 liters for a home tap and 100-200 liters for water in the kitchen and laundry (*ibid*). High consumption in the summer was due to the high temperatures and low consumption in the winter was attributed to the increase in the cost of water. Water consumption rates per household were lower in Gwanda (97.5 L), Beitbridge (105 L), and Mangwe (84 L) Districts in the southern dry Districts of Zimbabwe (ZEWSP, 2006). People adapted their water requirements to the supply and under conditions of shortage, much lower quality water may be used for personal hygiene and for washing clothes.

Environmental Health Risks Related with Sources of Drinking Water

According to the World Health Organization (2000), "In its broadest sense, environmental health comprises those aspects of human health, disease, and injury that are determined or influenced by factors in the environment''. This includes the study of both the direct pathological effects of various chemical, physical, and biological agents, as well as the effects on health of the broad physical and social environment, as the control of those factors in the physical environment that have or may have a deleterious effect on man's survival and well-being. It also defines health as a state of complete physical, mental, and social well being, not merely the absence of disease or infirmity. Contaminated water kills almost two million people per year and, according to a 2005 United Nations Children's Fund

report, more than 4,000 children die every day because they do not have access to adequate supplies of clean water (UNICEF, 2005).

Inadequate water supply and sanitation are largely responsible for the high levels of water borne diseases in Southern Africa, where the majority of people live in rural areas and do not have appropriate sanitation systems (Hirji, 2001; Hirji, 2002). Not surprisingly, infectious water borne diseases, such as dysentery, cholera, and hepatitis are almost endemic in places where water is scarce. Providing drinking water free of disease-causing agents (whether biological or chemical) is the primary goal of all water supply systems (Faggle and Rabie, 1992). According to the UN, 3.3 billion illnesses and 5.3 million deaths were caused annually by unsafe water on a global scale (UN, 1999; WHO, 2000). In terms of morbidity and mortality rates linked to water quality, this is certainly true and the number of infant deaths attributed to diarrhea transmitted by contaminated drinking water is a convincing argument. It is the rural populations, which are suffering the most from such contamination of drinking water. The numbers are and increasing at a rate, which makes it extremely difficult for water supply programs to achieve significant improvements over and above demographic developments.

Improving a water source may consist of fencing off a water source, constructing a distribution system, and treating the water before it is consumed. Waterborne pathogens can be blocked from entering a water supply and diseases can be largely barred from reaching the population (Elimndorf and Buckles, 1980). For example, consuming a bacterium called *Salmonella typhi*, which is found in human feces, causes typhoid. A treatment program can be initiated to remove the bacteria from the water before it can be consumed, protecting the users (WHO, 2006; Miller, 1996). Typical methods normally advised for inactivating microbes for rural water treatment at such levels are disinfection treatments (with the use of hypo chlorite) and boiling (with the use of heat) that have some efficiency on microbial content reduction. Although improved availability of water increases health benefits, an increase in the quantity of water used is not the only reason for health to improve. Effective use of water and the timing of hygiene practices can also hold important roles. In most cases, particularly where a large population is involved, there is very little choice of water source. For large populations, at least in the short term, what is usually needed is a source of surface water that can be treated by using techniques and equipment that are tried, tested, and available to produce sufficient water of adequate quality (Adams, 1999).

As with most African countries, getting clean, safe water everyday poses a major headache for many rural households in Zimbabwe. The unavailability of safe and clean water has exposed people to many waterborne diseases. This has been exacerbated by breakage of borehole stands and pulley ropes, damaged pistons, poor maintenance of water sources to prevent build-up of dirt, algae and weeds which clog the pump and pipes during suction, and breakdowns owing to suction of mud. Thus, the challenge of access to safe drinking water in communal areas is still largely a pipe dream and faces challenges in the wake of achieving the Millennium Development Goals by 2015.

STUDY AREA

Mundenda Village is located in Mutasa District approximately 51 kilometers north of the city of Mutare. The area is generally high above 1,000 meters covering the western ends of the Eastern Highlands. It is characterized by a multitude of undulating slopes and with a granitic basement. Soil depths depict great variations. The high points are shallow and achieving greater towards the valleys. The area is in natural farming region two with an average rainfall of above 600 millimeters per year.

Method and Material

This was a descriptive survey on access to safe drinking water by rural households in Mundenda Village in Mutasa District. Data was collected using a pretested questionnaire distributed to 50 randomly selected households from a population of 70 households (71% of the population), key informant interviews with traditional leaders, and field observations triangulated with secondary data sources. The questionnaire provided standardization and uniformity in data collected on the aspects of access to water and the constraints that were encountered in providing safe drinking water for the village. To guarantee high rate of return and to overcome the issue of illiteracy, personal interviews were conducted with the targeted heads of households. To complement this, key informant interviews were conducted with the village head, the environmental health technician, and a representative of the non-governmental organization that was active in water supply and sanitation in the area during the time of study. The accuracy of data collected was validated through field observations on available water sources, the conditions of the water sources, and the trips that women made to the wells. Effective field observations were achieved through the use of a prepared observation guide. This was done between September 2007 and April 2008.

The generated data was coded and synthesized to facilitate processing, checking and cross referencing the data, ranking of responses, and calculating proportions expressed as percentages. The data was thus organized and split into units searching for patterns and discovering the linkages between concepts, data, and responses from various respondents. Moreover, since the approach in this project was qualitative, primary data collected were based on the nominal and ordinal scales of measurement.

RESULTS AND DISCUSSIONS

Social Background of Respondents

The majority of the respondents were female (70%), as is common in rural areas across the country. Since the women are the ones most involved in the collection of water it is only reasonable that they attend meetings organized around water provision. It is possible that during the time of the study most men had migrated to towns in search of employment. On average, for every 91 men (aged 15-65) in the rural area there are 100 women, as a result of rural urban migration; thus, giving a variation from the traditional dominance of male-headed households to a more female-headed pattern. The reasons for this cannot only be restricted to the idea of migration but also to the impact of HIV/AIDS on rural communities.

With regards to ages, the respondents were fairly middle aged; thus, an active population that was critical on sourcing water and participating in the development of water points. On average, the respondents also attained basic secondary education, a feature that was important in terms of their levels of environmental awareness and knowledge on water and sanitations issues. The length of stay of the respondents in the area strengthened the criticality of this variable. Experience and knowledge usually goes hand-in-hand with the length of attachment one has within the area of study. They were, on average, better informed on the developments related to water and sanitation issues in the area including the historical profiling of the measures implemented and their levels of success. They were also in a position to provide options to water development programs as a means to achieve water and sanitation for all in the village.

The sizes of households varied from as small as one person to as many as 5 persons with a mean household size similar to the national limit of 5 persons per household. The size of the household was a more accurate indicator of the volume of water that could be consumed per day and per year by the entire community. Taking into consideration a minimum consumption rate of 30 liters per day per person, each household consumed an estimated 150 liters per day; when multiplied by the 70 households that comprised the community, a daily consumption rate of 10,500 liters was achieved.

Access to Water

The Villagers had access to one protected primary source of water (borehole). The borehole had a low yield averaging seven drums (1,400 liters per day) of water during the greater part of the summer season and dropped to an average of three drums (600 liters per day) during the dry season. This threshold falls far short of the average water requirements calculated basing on the size of the household (10,500 liters). This would give a difference of 1,900 liters in summer and 9,100 liters in the dry season. The households would then cover the short fall through trapping water from rooftops during summer and fetching water from unprotected sources for the greater part of the dry season. These secondary sources of water (alternative sources used when there is no supply from the borehole) had great bearing on the issue of access to water. During the dry season the situation was worse, such that the only times they would have water was early in the morning and the evenings, as water tables drastically fell. To compound the water supply problem within the community, the borehole would often break down and was rarely attended to in time. This tended to increase distances to the water point and the workload for mainly the women and children.

Rural African women use 40% of their daily nutritional intake traveling to collect water (World Bank Report, 2000). They carry full containers of water weighing up to 20 kilos. Carrying such burdens can cause damage to the spine and pelvis creating future problems in pregnancy. On average, the female member of the household make two to three trips everyday of the week, carrying a total of 60 liters daily from the water collection points. This consumes most of their productive time. Distances to the water point ranged between 500 meters to about 5 kilometers on average. Considerable time, proportional to distance traveled, was also spent on trips to water sources ranging from as low as 10 minutes (33%) to about above forty-one minutes (33%). According to the World Health Organization (2000), a human being needs about five liters of water each day for cooking and drinking. However, good health and

cleanliness require a daily supply of about 30 liters per person, or about 11 cubic meters (m^3) per person per year, but this was not the situation prevailing in the study area.

The volumes of water used per household varied greatly, but the majority (60%) used 50 liters of water and above per day (Table 1).

Table 1: Amount of Water Used Per Day

Liters (L)	Number of people	Frequency %
10-20	3	6
21-40	5	10
41-60	12	24
More than 50	30	60

Source: Field Results March 2008

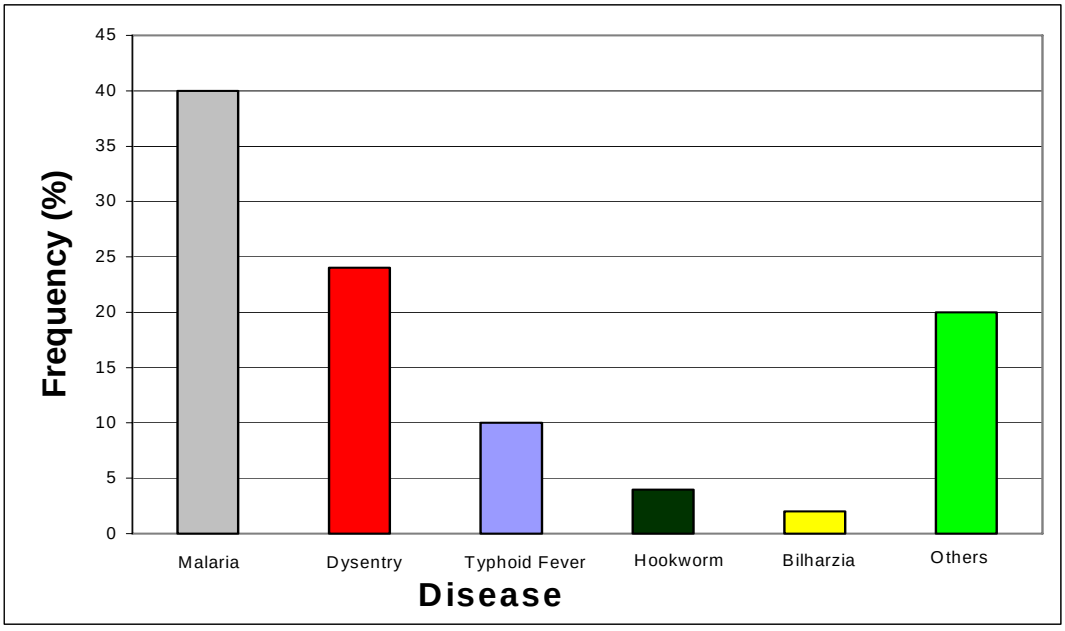
The villagers used water for various purposes, which included bathing, cooking, drinking, and washing. The water available was inadequate for a household of five people. The average volume of water available per household was 46.5 liters or 9.3 liters per capita per day. This was higher than what was established in other parts of the country, but short of meeting basic daily requirement for a healthy life (30 liters). Thus, the right of an individual to have access to adequate quantities of water was constrained.

The main water point was a communal property, although 20% of the households owned some deep wells, provided by Pump Aid Zimbabwe (a local non governmental organization), around their homesteads. Access to these individually owned water points was often limited, given the fragility that the water withdrawal system has too large of numbers. Thus, the borehole technology remained the most appropriate system to withdraw ground water for large communities. The issue of ownership of a water point is important as it is directly related with maintenance levels. Adequate maintenance is required to sustain water point infrastructure. It is critical that households without their own water sources develop their own water points so as to improve access to safe drinking water. However, this objective was constrained by the shallow granitic basement. Other obstacles to lack of access to water included lack of cooperation by the community, frequent breakdowns of borehole, lack of a consistent maintenance program, and the increasing demand for water. It also became difficult for them to exercise personal hygiene, like bathing and washing of clothes daily. A lot of productive time was diverted from other income generating activities, as more time was spent walking and queuing for water.

Water Quality and Related Environmental Health Risks

The borehole was rated as a safe source of drinking water by 90% of the respondents. The reason for this view was the limited health problems related with the use of this source as no known reports of contamination were given. However, the erratic borehole maintenance program exposed a proportion of the population to environmental health risks that included waterborne and water related diseases. Thus, they used (90%) water from Odzani River for bathing, washing, and gardening purposes where diseases were probably transmitted through contact with dirty water. Problems faced in the treatment of water included lack of funds to buy purifying chemicals, lack of a substantive water maintenance program, and limited support from the water authorities that included The District Development Fund (DDF) and the Zimbabwe National Water Authority (ZINWA). The earlier has since handed over the water point management to the communities who are expected to mobilize resources for themselves. Although some training of local people, including some of the pump minders who originally worked for the DDF, was done this was not enough to empower them. The mentality that the water point is a common resource, subjects the resource to the general degradation that is associated with common property resources. The utilization of such resources tend to be open access with no binding inclusion and exclusion mechanisms, as free riders take advantage of the water point without contributing towards its management.

Figure 1: Incidence of Water Related Disease



Source: Field Results March 2008

The respondents indicated that they suffered from a wide range of water related diseases, including dysentery, diarrhea, malaria, typhoid fever, and hookworm (Figure 1). Sickness among the community impacts in various ways, including absenteeism or complete dropout from school. Sickness from water related diseases is one of the major contributors to absenteeism from school in most rural areas of the developing countries and worldwide it was estimated that 443 million school days were lost annually due to problem of access to water (World Health Organization, 1997).

Conclusions

Most of the residents of Mundenda village use one protected water source during times when the borehole is functional and may also resort to the use of unprotected water sources during times of drought. Most residents travel more than 500 meters to the nearest water source, spending more than 30 minutes per trip. This impacts the health of the water carrier because water is mostly carried on the head. These conditions lead to minimal water per household. The average water use per capita per day was 9.3 liters, indicating the need to improve access to water in adequate quantity and quality. This is critical in preventing water related and water borne diseases. Proper storage and maintenance of the water source reduces the risk of contamination or of exposing the community to diseases. However, maintenance and the effort needed to draw water from the borehole were factors observed as constraining access to water of good quality. The community has the capacity to assist in program implementation and they are willing to be trained as village pump mechanics and water point committee members, and to participate in community organization. All these are positive indicators towards attaining sustainability

RECOMMENDATIONS

- Improve water supply access to through:
    - Drill, repair and/or rehabilitate boreholes the borehole
    - Continue with the program of individually owned deep wells
- Awareness programs must be planned for the community on issues that relate to treatment of water fetched from unprotected sources
- Provide materials for the construction of sanitary facilities, which most households cannot afford
- Improve sanitation through:
    - Conducting participatory Health and hygiene Education workshops in the community

- Educate and articulate on the importance of sanitary facilities
- Educate and promote the critical times for washing hands
- Educate and promote the proper techniques for washing hands
- There is need to improve the sanitation conditions at a community or individual household level
- At households there is need to change hygiene behaviors such as ensuring that there is appropriate use and maintenance of toilets, clean water use and its storage, proper disposal of children's excreta, and the control of flies around homesteads

- Community awareness on hygiene through the following:
  - Prepare and distribute hygiene awareness teaching material (e.g.,
  - manuals, training aids, and strategies of intervention)
  - Recruit and train peer health educators for the sustainability of the
  - program

REFERENCES

Adams, J. (1999). Managing Water Supply and Sanitation Emergencies, Published By Oxfam GB.

Bhatia, R., Gestti, R. and Wimpenny, J. (1996). Policies for Water Conservation and Relocation. Good practice Cases in Improving Efficiency and Equity. World Bank Washington D.C.

Elimndorf, M and Buckles, P. (1980). Appropriate Technology for Water Supply and Sanitation. Volume 5, Socio-Cultural.

Elimndorf, M. and Buckles, P. (1980). Appropriate Technology for Water Supply and Sanitation. Vol. 5, Socio-Cultural.

Faggle, R.F. and Rabie, M.A. (1992). Environmental Management in South Africa. Juta Company, Cape Town.

Falkenmark, M. and Widstrand, C. (1992). Population and Water Resources: A delicate balance in Population Bulletin Vol.47 No. 3 Washington USA. 300 I Street, NE, Washington, DC 2002.

Harvey, P. and Reed, B. (2004). Rural Water Supply In Africa, Water, Engineering And Development Centre Loughborough University.

Hirji, R. (2002). Environmental Sustainability in Water Resources Management in Southern Africa. SARDC.

Hirji, R. (2001). Water Resources and Environmental Management. World Bank Environment Strategy Paper 2 World Bank Washington D.C.

Hutton, G. and Haller, L. (2004). Evaluation of the Costs and Benefits of Water and sanitation improvements at a global Level. World Health Organization Geneva.

Katsi, L. (2006). Zimbabwe Gender Mainstraeming in Water Supply and Sanitation in Manzvire Village, Chipinge District. http://www.unicef.org/infobycountry/zimbabwe.html

Miller, G. T. (1996). Living In the Environment 9th Edition Wadsworth. Publishing Company USA.

Morgan, P. (1990). Rural Water Supplies and Sanitation, Blair Research. Laboratory, Ministry Of Health, Harare.

Morgan, P. (1999). Case Study Of Zimbabwe's Rural Sanitation Programme, Presentation To the World Bank.

SADC/IUCN/SARDC (2002). Defining and Mainstreaming Environmental Sustainability in Water Resources Management in Southern Africa, CEP, Maseru/Harare.

Seckler, D., Molden, D. and Backer, R. (1998). World Water Demand and Supply, 1990-2025: Scenarios and Issues. Research Report 19. Calambo, IWMI.

Stockholm Water Front (2006). A Forum for Global Water Issues, Stockholm.

Tevera, D.S. (2004). Regional Geography of Southern Africa, Module GED 402, Zimbabwe Open University, Harare.

UN (2003). World Water Projects, Water for the People, Water for life: World Water Assessment Programme, UNESCO and Berghm Books.

UNICEF (1995). Strategies in Water and Environmental Sanitation.

WHO/UNICEF (2000). Water Supply and Sanitation Assessment Report. Geneva wwwhoint/water sanitation-health/globassessment/globalTOChtm.

World Bank (1992). Water Supply and Sanitation Projects. World Washington DC.

World Bank Report (1995). Workers in an Integrating World. Oxford University. New York.

World Health Organization (1973). World Health Statistics Report, no, 26 pp 720-783.

World Health Organization (1994). Guidelines for the Management of operation and Maintenance of Urban Water Supply and Sanitation systems. Geneva Switzerland.

World Health Organization (1997). Guidelines for Drinking water quality: Surveillance and control of community supplies, 2nd ed., World Health Organization, Geneva www. Who.int/water-sanitation health/GDWQ/PDF-doc/gdw3.pdf.

WHO/UNICEF/WSSCC (2000). Water Sanitation Coverage By region. WHO.

Zimbabwe Emergency Water And Sanitation Project (ZEWSP) (2006). Baseline Survey Report December 2005-May 2006 Mangwe, Gwanda And Beitbridge District (Matebeleland South Province World Vision, Inc Headquarters Mailing Address)