

WATER SUPPLY AND SANITATION IN NEW RESIDENTIAL AREAS IN ZIMBABWEAN TOWNS: THE CASE OF MARIDALE HIGH-DENSITY SUBURB IN NORTON

Tanyaradzwa Chigonda

ABSTRACT

The study sought to assess water supply and sanitation in the new high-density suburb of Maridale in Norton. Evidence is mounting that most cities and towns in Zimbabwe are increasingly failing to provide adequate and safe domestic water to their residents, and that such water supply problems are more acute in newly established suburbs, as water supply infrastructure can no longer meet new demand. A questionnaire was administered to 400 housing units in Maridale. Key informants also provided valuable information through personal interviews. Laboratory tests for eight water samples were also conducted in order to establish the quality of domestic water in Maridale. The study revealed that domestic water supply in Maridale, both in terms of quality and quantity, is far from satisfactory and this has exposed residents to various water-related challenges and risks. Of major concern is the high coliform count in both tap and well water. The study recommends that Norton Town Council should construct its own water treatment facility and wean itself from a precarious dependency on Harare's water treatment facilities. Measures are also suggested in order to improve the quality and quantity of well water, now a major domestic water source in Maridale.

Keywords: water supply and sanitation, water quality and quantity, coliform

INTRODUCTION

'Water is the best of all things', said the eminent Greek philosopher, Pinda (Biswas, 1998). Although Pinda lived two and a half millennia ago, the importance of his statement is becoming more and more evident, particularly in the provision of safe drinking water to citizens in the world. This is because water is the only scarce resource for which there is no substitute. As global populations continue to grow exponentially, especially in the developing world, and as environmental change threatens the quality and quantity of natural resources, the ability of nations to meet growing water demand has been pushed to the limit (Piriera, 1973; World Bank, 1989).

More than a billion people in developing countries lack safe drinking water. Nearly 3 billion people live without access to adequate sanitation systems necessary for reducing exposure to water-related diseases, hence causing unnecessary and preventable suffering. An estimated 14-30 thousand people, mostly young children and the elderly, die every day from water related diseases, while approximately half of the people in the developing world suffer from diseases caused by drinking contaminated water (Catley-Carlson, 1993).

Water is increasingly becoming a scarce resource in Zimbabwe. Demand for water is growing for domestic, industrial, agricultural, mining, and institutional needs, the five major consumptive uses of water in Zimbabwe, and with it, the costs of water treatment (Chenje, Sola, & Paleczny, 1998). Zimbabwe's freshwater resources are threatened not only by overexploitation, but also by poor management and ecological degradation. Substandard sewage effluent is discharged into water bodies and runoff from agricultural fields, treated with herbicides and pesticides and containing eutrophic nutrients, contaminate the country's water resources. Industries, mines, landfill leachate, and soil erosion and siltation also add to the list of the sources of pollution for surface and subsurface water resources in Zimbabwe (Bagg, 1992; Mtetwa, 1995). Indeed there has been a decrease in water quality in those rivers and lakes near major urban and industrial centers. Lake Chivero, the source of raw water for Harare and also Norton, provides a classic example of the consequences of pollution. The cost of treating water has gone up and massive algal and macrophyte blooms have occurred, causing taste and odor problems in drinking water (Magadza, 1997; Marshal, 1997). Yet actions to conserve available water and to care for the quality of water have been sporadic, uncoordinated, and ineffective.

Evidence is mounting that treated drinking water in Zimbabwe is increasingly playing a role in the transmission of pathogens to consumers. For example, treated drinking water was estimated to be responsible for 35 percent of household gastroenteritis infections in the country in 1995. The majority of infections associated with drinking water, which met established criteria, were caused mainly by viruses, bacteria, and protozoan parasites (Ministry of Health and Child Welfare, 1995; Chenje, Sola, & Paleczny, 1998). These observations show shortcomings in the quality surveillance programs used. The economic challenges facing Zimbabwe, which started in 2000, have worsened the supply of treated drinking water to most urban areas in the country as shortage of foreign currency prohibits the importation of water treatment chemicals. The cholera epidemic, which started in August 2008 and claimed the lives of approximately 4,000 people out of an estimated 100,000 reported cases, has strongly been linked to the deteriorating drinking water supply situation in the country (The Standard, 2008; The Herald, 2009).

Norton Town gets its treated water supply from the Morton Jeffrey Water Treatment Plant, the same source of water for Harare, Chitungwiza, and Epworth. This has created a huge water demand of about 3.5 million people, approximately 20 percent of the country's population (Central Statistical Office, 2002). The main source of raw

water, Lake Chivero, is also the most polluted in the country (Magadza, 1997; Marshal, 1997). This has engulfed Norton into a persistent water supply problem. In spite of this water supply challenge, Norton has continued to grow from 3 suburbs, in 1980, to 11, currently. Such phenomenal growth has added to the water supply problem. The impact of inadequate water supply in Norton, just as in other towns in the country, is mainly being felt by the residents of newly established suburbs, like Maridale, as the water supply infrastructure's capacity is no longer able to effectively accommodate them due to already high demand. While research on water supply and sanitation has been conducted in Harare and Chitungwiza, cities sharing the same water source and challenges with Norton, none such studies on water supply and sanitation have been carried out in Norton. This paper, therefore, attempts to bridge this gap in research concerning the water supply and sanitation situation in Norton, particularly in the newly established suburb of Maridale.

The objectives of the research were threefold: first, to establish the sources and quantities of domestic water being accessed by Maridale residents; second, to assess the quality of the domestic water used by the residents; and thirdly, to examine how the established water supply situation in Maridale has impacted upon sanitation in the suburbs.

DESCRIPTION OF THE STUDY AREA

Norton town is located 40 km to the west of Harare, the capital, along the Harare-Bulawayo highway in Mashonaland West Province. According to the 2002 national census, Norton had a total population of 65,000 inhabitants (Central Statistical Office, 2002).

Maridale is one of the high-density suburbs in Norton. It was established in 1999 when a private property developer, Adore Gold Private Limited, was awarded a development permit by Norton Town Council to develop a farm, Marshlands Farm, into a residential area. The developer opened up roads, sewer, and water pipes and people started building houses in 2003. To date, there are 3,111 (150m²) housing units. A second phase for Maridale, comprising 10,795 housing units, is in the planning stage.

A pilot survey in October 2008 established the average number of people per housing unit in Maridale to be approximately 9 occupants. This translates into an estimated population of about 28,000 inhabitants, which makes Maridale an ultra high-density suburb. The high number of people in Maridale, just as in other high-density suburbs in Zimbabwe in general, has been caused by housing shortages, which have seen most people resort to lodging. Some housing units are shared by three or more families, thereby resulting in overcrowding. It was this background information about Maridale high-density suburbs, which created occasion for the researcher to carry out an in-depth investigation into the water supply and sanitation situation in the study area. Such a research interest was further fuelled by the water supply challenges already hounding the older suburbs in Norton.

RESEARCH METHODOLOGY

The study was conducted between December 2008 and May 2009. A pilot survey was conducted in October 2008 in order to test and improve research instruments and also have a better appreciation of the study area. A questionnaire was designed for Maridale residents to solicit for information that included sources, adequacy and quality of accessed domestic water, coping strategies, and water-related sanitation challenges, among other issues. Closed-ended questions were used in order to enable quantitative analysis of data. Four hundred (400) housing units, representing approximately 13 percent at the target population of 3,111 housing units in Maridale, were selected. Systematic sampling was employed by using a sampling interval of two, with every third house included in the sample. The linear layout of housing units enabled the use of a uniform sampling interval and this made sure that the sample was drawn from across the whole study area.

Key informants for the study included representatives from the Department of Housing and Community Services, the Engineering Department, and also the Department of Environmental Health for Norton through personal interviews. Other key informants included the chairperson for Maridale Residents Association, the sister-in-charge at Katanga Utano Clinic, and a Zimbabwe National Water Authority (ZINWA) representative.

Eight water samples, which included two from very shallow wells (<2 meters), one protected and the other unprotected; two from shallow wells (2-4 meters), one protected and the other unprotected; two from fairly deep wells (> 4 meters), one protected and the other unprotected; one from tap water; and finally one from a major storm water drain that cuts across Maridale, were collected and sent to a private laboratory for tests. Samples for well water were randomly selected from the wells across the study area. A laboratory technician from the laboratory which executed the water tests was hired to collect the water samples. This ensured that the samples were properly collected and safeguarded from contamination during and after collection. The tests mainly targeted the presence of coliforms in the water since these have traditionally been used as an indicator for the presence of pathogenic microorganisms in water. A further test for chlorine levels was also conducted for tap water.

The responses from the questionnaire survey and personal interviews, together with the water test results, in conjunction with other secondary data, were then used in writing up the research report. The information gathered through the above instruments was deemed fairly adequate by the researcher to address the research objectives.

RESULTS AND DISCUSSION

Sources and Quantities of Domestic Water in Maridale

The study sought to establish whether the residents of Maridale were accessing adequate water for their various domestic needs. It revealed that 78 percent of the interviewed households were connected to the council water reticulation system, while the remaining 22 percent were not yet connected. However, of those connected to the council water supply system, all said that they were not getting adequate water. Asked to rate the water supply service in their area between poor, good and excellent, all the respondents rated it as poor, as the water supply service is almost non-functional. Sometimes the water flows after several weeks or even months and, in all cases, the pressure will be too low to relieve the residents of their bleak water supply situation.

With all the respondents connected to the council water supply system saying that they were not getting adequate water, the study then sought to establish how they were coping. Seventy-five percent said that they had dug out some wells at their homes. However 38 percent of those who had dug out wells said that their wells ran out of water, especially in winter or when over-fetched. Sometimes the hydrogeological conditions are such that some wells are shallow and can, therefore, not produce a lot of water. Some wells were as shallow as two meters and their advantage of filling up fast in the summer translates into the disadvantage of also drying up faster in winter. Thirty-five percent of the wells were considered to be very shallow, 45 percent were shallow, while the remaining 20 percent of the wells were considered to be fairly deep.

For those Maridale residents not yet connected to the council water supply system, 70 percent cited prohibitive connection costs mainly due to expensive piping. Another 62 percent said that there was no need, at the present moment, to get connected to council water supply, as the reticulation system for the area is dry most of the time. These have deferred connection with the seemingly elusive hope that the water service will eventually improve. Surprisingly, however, only 57 percent of those not connected to council water supply had dug out some wells, with the remaining 43 percent outsourcing water either from neighbors' wells or from acquaintances residing in areas with a better council water supply service. Such households, therefore, virtually have no water, thereby making their lives vulnerable considering the undisputed fact that water is life.

The recommended basic daily water requirement per capita, also referred to as the lifeline per capita water consumption, is 50 liters (Gleick, 1996). This includes water for food preparation (10 liters), drinking (5 liters), bathing (15 liters), and sanitation services (20 liters). However, taking into consideration both sources of domestic water, that is tap and well water, only 22 percent of the interviewed Maridale residents said that they were accessing this daily per capita water requirement. Some residents were managing to get as little as 30 liters

of water per day for the whole family. This leaves 78 percent of the residents without access to the recommended lifeline per capita daily water consumption. The situation is further worsened by the relatively large numbers of occupants per housing unit in Maridale, averaging about 9 inhabitants as several families occupy the same house due to housing shortages.

While most of the interviewed Maridale residents are connected to the council water supply system, the service is almost non-functional as there is no water most of the time. While the people have resorted to wells as their main source of water, such wells have also been overwhelmed by high and ever increasing demand. This is because not all of the residents have dug out wells, while most of the available wells cannot supply water throughout the year as they are shallow. This has seen the majority of Maridale residents fail to satisfy their domestic water requirements. The next section of the paper looks at the quality of the water that Maridale residents are getting.

Domestic Water Quality in Maridale

When assessing the adequacy of water supply in any community, in addition to water quantity, the quality of the water that the people are using is also of crucial concern. To satisfy the water demand of a community, both the quantity and quality of the water should be taken into serious consideration. It was, therefore, one of the aims of the research to establish the quality of water that Maridale residents are accessing.

All the interviewed residents said that the water being supplied through the council reticulation system was of substandard quality citing various reasons. All respondents said that the water was often dirty, 96 percent said the water usually contains some visible suspended organic and inorganic substances, while all the respondents also said that the water had an unpleasant taste. All respondents also said that tap water sometimes smells badly, while 70 percent said that, when boiled, the water will have its already unpleasant taste worsened due to impurities contained in it.

Several factors account for the poor quality of tap water. Firstly, the main source of raw water for Norton, Harare, Chitungwiza, and Epworth, Lake Chivero, has tons of raw sewage pumped into it because Harare's sewage treatment works run by the Zimbabwe National Water Authority (ZINWA), have collapsed. Secondly, water purification chemicals at the ZINWA-run Morton Jeffrey Water Purification Plant, from where Norton buys its water, often run out due to shortages of foreign currency to import these chemicals (The Herald, 2009). This leaves ZINWA with two options of either stopping the provision of water to consumers or that of pumping under-purified water to the consumers. The fact that the second option is prevailing is apparently clear. Thirdly, and particularly for Maridale residents, the long periods of dry taps promote rusting. This rust will then come out together with the water thereby exacerbating the already unpleasant taste, notwithstanding the health risks

associated with the rust. Residents said that reddish tap water, due to rust, is common whenever tap water is available.

With well water now acting as the major source of domestic water for Maridale residents, ascertaining its quality became imperative. Fifty three percent of the respondents rated the quality of well water as good, 32 percent rated it as bad, while 20 percent rated it as bad but far much better than tap water. For those respondents who rated the water as bad, 66 percent said that most of the wells are not properly protected thereby exposing the water to various sources of contamination. It is worth noting that the study area has a problem with constant sewage outbursts due to overcrowding and this poses a threat particularly to shallow and under-protected and unprotected wells. Seventy percent of the respondents said that some of the well water is milky white and therefore not suitable for most domestic uses. With about half of the respondents rating well water as bad, the role of well water in alleviating the water supply situation in Maridale is, therefore, greatly diminished.

Further attempts were made in order to scientifically establish the quality of tap and well water in Maridale. Eight water samples were tested for selected bio-chemical parameters and Table 1 presents the water test results.

Table 1: Water Test Results For Various Water Samples in Maridale.

Water Sample	Fecal coliform Count/100ml	Non- fecal coliform Count/100ml	Total coliform Count/100ml	Chlorine Content Mg/100ml
Tap Water	Nil	27	27	65
Very shallow unprotected well	17	38	55	
Very shallow protected well	21	27	48	
Shallow unprotected well	19	43	62	
Shallow protected well	23	24	47	
Deep unprotected well	18	26	44	
Deep protected well	23	29	52	
Storm Drain Water	Too numerous to count	Too numerous to count	Too numerous to count	

As the table shows, all the well water samples tested positive to both fecal and non-fecal coliforms. This is quite alarming, as World Health Organization standards require that domestic water should not contain a single

coliform (World Health Organization, 1993). Several important observations that are seminal in fully appreciating the contribution of well water towards meeting water demand in Maridale can be deduced from the above results. Firstly, it is apparent that well water in Maridale is not safe for direct human consumption as it contains coliforms, an indicator of the presence of pathogenic microorganisms in water. Secondly, there seems to be no strong positive relationship between depth of well and presence or absence of coliforms as both shallow and deep well water contains coliforms in more or less the same quantities. Thirdly, as above, there also seems to be no strong positive relationship between protection of wells, or lack of it, and presence or absence of coliforms, as both protected and unprotected wells also contain coliforms. The nature of protection, that is its effectiveness, therefore becomes more important as cracked or pervious well walls can allow contamination. Another important observation concerns the heavy presence of both fecal and non-fecal coliforms, too numerous to count, in storm drain water. Since the drains in Maridale are not lined with impervious material and are often blocked by various obstacles drain water, which usually contains effluent from sewage outbursts, it eventually seeps into the soil thereby contaminating groundwater. While tap water was free from fecal coliforms, it had a fairly high total coliform count. The chlorine content in tap water of 65 mg/100 ml was also far below the World Health Organization recommended (150 mg/100 ml) (World Health Organization, 1993), hence the presence of total or non-fecal coliforms in treated water.

The preceding has shown that the portability of domestic water in Maridale, both well and tap water, based on respondent views and laboratory tests, is highly questionable which makes the water unsuitable for direct human consumption. The next section discusses sanitation issues surrounding domestic water supply in Maridale.

Water-Related Sanitation Issues in Maridale

After establishing the sources, quantities, and quality of domestic water in Maridale, the study then sought to assert how this impacted sanitation in the study area. This is because the water supply of an area directly affects its sanitation in various ways.

With most of the residents saying that they were not getting adequate quantities of water for their various domestic needs, it became imperative to assess how such shortages were affecting the people in their day-to-day activities. Eighty-five percent of the respondents said that inadequate water supply had badly affected their use of the toilet, while all of them said that laundry and bathing had also been adversely affected. Some respondents said that they are often forced to put on the same clothes for unusually longer periods before washing them, while others said that they now use less water for bathing and laundry than they would had water been adequately available. This is likely to cause some skin and other diseases associated with dirtiness, including the proliferation of parasites, such as lice, though no single respondent openly confirmed this.

As a coping strategy for negatively affected toilet flushing due to water shortages, 48 percent of the respondents admitted that they sometimes use open spaces in the suburb, particularly at night, in order to relieve themselves. Such a practice is most likely to contaminate the dugout wells, especially the shallow and unprotected or under protected ones, thereby posing a health hazard to the residents. This most probably explains the high fecal coliform count in well water. The risk of diseases being spread by flies is also heightened. Fifty-two percent of the respondents said that they are often forced to continue using the toilet, even without water, only to flush it later, which predisposes them to diseases and bad odors. The remaining 10 percent said that they had illegally constructed some pit latrines. However pit latrines have a problem with bad odors and they also can more effectively contaminate groundwater. Churches and schools in the area have also resorted to pit latrines. All this probably accounts for the high fecal coliform count in well water in Maridale. In addition, owing to the small sizes of the residential stands in Maridale (150 m²), a single pit latrine is capable of contaminating several wells, notwithstanding the predominantly sandy loam and well drained soils that define the pedology of the study area.

When asked where they get their water for drinking from, all the respondents cited the wells and the taps as their sole sources. However, it was quite disturbing when 48 percent of the respondents said that they did not treat the water in any way before drinking. Couple this with the fact that 53 percent of interviewed residents considered well water to be of good quality thereby giving them a false and fatal confidence in the water. Only 52 percent of the respondents said that they either boiled or chlorinated their water before drinking. All this exposes the people to various water-related diseases.

Between August 2008 and March 2009, Zimbabwe was hit by a cholera outbreak which claimed approximately 4,000 lives out of over 100,000 reported cases, countrywide. As this outbreak coincided with the timing of this research, it became crucial to establish the situation in Maridale owing to its bleak water supply situation. It has been revealed through this study that, out of the 63 reported cholera cases at Katanga Utano Clinic, which acted as the center for cholera treatment for Norton, 36 percent of the cases were from Maridale high-density suburb, a considerable percentage considering the fact that there are as many as 11 suburbs in Norton. The above could most probably be linked to the established water supply situation in Maridale. In addition, 20 percent of the respondents said that they experience constant stomach pains, which could be an indication of gastroenteritis often associated with drinking water contaminated with coliforms, though this could also be attributable to other reasons.

CONCLUSION AND RECOMMENDATIONS

The study has revealed that water supply in Maridale, judged in terms of both quantity and quality, is far from satisfactory. This has compromised sanitation in the suburb in various ways, thereby exposing the residents to myriad water-related challenges and health hazards. The fact that Maridale has not yet experienced a major and exclusive water supply related disease outbreak in spite of its bleak water supply situation should not be used as justification for inaction or indifference as prevention is always better than cure. The paper suggests some recommendations aimed at improving the various aspects of water supply in the study area and Norton, at large, in order to ensure high sanitary standard among the residents.

To begin with, the takeover of the role of water supply in the country by ZINWA from municipalities has proved to be a failed experiment. This has seen municipalities with long years of experience in water supply being replaced by a vastly inexperienced and inefficient organization. While Norton is one of the few towns in the country whose water supply infrastructure has not yet been taken over by ZINWA, the fact that it buys all its purified water from the same organization puts it in exactly the same, if not worse, situation with those towns, whose water supply infrastructure has been taken over. The role of supplying water to residents should, therefore, be handed back to municipalities, which, over many years, had acquired vast experience in water supply.

In line with the above, Norton Town Council, which has never treated its own water, should construct its own water purification facility, preferable at the nearby Lake Manyame. This will greatly improve water supply in the town, as its population of 65,000 residents is less likely to cause overwhelming water demand. Such a move will also come with lower water treatment costs as Lake Manyame, unlike the heavily polluted Lake Chivero, will provide a cleaner source of raw water. Ruwa, another of Harare's satellite towns, has successfully weaned itself from dependency on Harare's water supply by constructing its own water purification facility.

The above recommendations require a time lag before they are implemented. Therefore, Norton Town Council should come up with more instantaneous measures to improve water supply in Maridale. This could be in the form of some community taps dotted across the suburb. Alternatively council could also sink some boreholes. It could also encourage the use of water purification tablets by providing them to residents at a break-even price, in conjunction with the promotion of other cost-effective water treatment methods, such as boiling. Norton Town Council should ensure that persistent sewage outbursts in the suburbs are rectified effectively. The drainage network should also be lined with concrete or other impervious material so that, in the event of a sewage outburst, groundwater contamination is avoided. Pit latrines should be banned outright and all those which have been constructed should be cleared of their contents and be filled up with soil treated with disinfectants in order to stop

any further contamination of groundwater. Heavy punitive measures should be put in place in order to effectively deter offenders.

The residents of Maridale should also play their part in improving the water supply situation in their area and not just wait upon the council. While wells have become an important source of water, residents should adopt measures to improve the capacity and quality of this water source. Firstly, the wells should be well protected and deep enough in order to ensure an all-year round supply of safe water. Secondly, all residents should treat both well and tap water before drinking in order to ensure maximum safety from contamination. Residents should also desist from using open spaces to relieve themselves as this threatens well water with contamination. Those residents not yet connected to the water reticulation system should ensure that they have also dug deep and effectively protected wells at their homes.

The right to safe drinking water is also among the basic human rights enshrined within the United Nations Human Rights Charter and also within the Constitution of Zimbabwe. However, this human right seems to be getting less attention compared to the other rights on the human rights spectrum, such as, *inter alia*, the right to freedom of expression or the right to freedom of association. This poses a challenge to human rights promoting organizations, be they governmental or non-governmental, to step up efforts in creating awareness to such a right among the people, in addition to efforts to ensure adequate and safe drinking water through, for example, the sourcing of funds for the construction, maintenance, and refurbishment of water supply infrastructure.

REFERENCES

- Bagg, W. K. (1992). River Pollution in Harare. *Geographical Education Magazine*, 15(1), 7-15.
- Biswas, A. K. (1998). *Water Resources: Environmental Planning, Management and Development*. McGraw Hill, Oxford.
- Catley-Carlson, M. (1993). *Water Supply and Sanitation Monitoring*. World Health Organization, Geneva.
- Central Statistical Office. (2002). *Zimbabwe National Census 2002*. Government Printers, Harare.
- Chenje, M., Sola, L. & Paleczny, D. (1998). *The State of Zimbabwe's Environment 1998*. Government Printers, Harare.
- Gleick, P.H. (1996). Basic Water Requirements For Human Activities: Meeting Basic Needs. *Water International*, 21(2), 83-92.
- Magadza, C.H.D. (1997). *Water Pollution and Catchment Management in Lake Chivero*. In *Lake Chivero: A polluted Lake*. University of Zimbabwe Publications, Harare.
- Marshal, B. E. (1997). *Lake Chivero After Forty Years: The Impact of Eutrophication*. In *Lake Chivero: A Polluted Lake*. University Of Zimbabwe Publications, Harare.
- Ministry of Health and Child Welfare. (1995). *Zimbabwe National Health Profile 1995*. Government Printers, Harare.

Mtsetwa, S. (1995). No Room for complacency: Water Pollution in Zimbabwe. *Waterlines*, 14(1), 7-10.

Piriera, H. C. (1973). *Land use and Water Resources*. Cambridge University Press, Cambridge.

The Herald. (2009). Harare Water Sources Condemned: WHO Experts Call for Urgent Remedial Action. ZimPapers Publishing, Harare. February 16.

The Standard. (2008). Doctors Say Cholera Toll Now 800. ZimPapers Publishing, Harare. November 30 to December 6.

World Bank. (1989). *Population Pressure, The Environment and Agricultural Intensification*. World Bank, Washington DC.

World Health Organisation. (1993). *Water Quality Guidelines*. WHO, Geneva.

AUTHOR:

Tanyaradzwa Chigonda

Department of Geography and Environmental Science, Great Zimbabwe University