Water Supply and Requirements of Households in the Luvuvhu-Letaba Water Management Area of South Africa

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Abstract

The purpose of the study was to characterize households in Luvuvhu-Letaba Water Management Area and to investigate the adequacy of their water supply. Respondents from 467 households in three municipalities in the area were interviewed. Most (34.8%) heads of household were 36-50 years old. Some 41.1% of households earned R0-R1000 while 40.4% earned R1001-R5000 monthly. Half (50.1%) of households obtained water from street taps. Some 46.7% of them, mostly elderly families resided < 1 km from water sources. Households used water mostly for basic activities of drinking (95.9%), preparing food (95.4%) and bathing (92.8%) with fewer using it for productive activities of washing cars (6.6%) and watering crops (5.7%). Half (51.7%) of the households had < the 25 litres per capita per day supply standard while requirement was 37.5 litres per capita per day. The households had inadequate water supply.

Keywords: Municipality, household, basic use, productive use, supply standard

1. Introduction

Water is one of the most indispensable substances for human daily life and survival (Aiga and Umenai, 2002). Access to adequate supplies of water is a universal indicator of human well-being and development (Potter and Darmame, 2010). Lack of access to safe and improved water supplies in developing countries is a major concern since water is a basic need for sustenance (Mazvimavi and Mmopelwa, 2006). Some 900 million people in the world do not have access to safe drinking water (Manase *et al.*, 2009). Potter and Darmame (2010) revealed that almost one sixth of the world population of 6.1 billion remains without access to improved water supplies.

Close to 6 million people do not have access to a reliable source of safe drinking water in South Africa (Manase *et al.,* 2009). It is therefore understandable that the Millennium Development Goals included a target of reducing by half the proportion of people without sustainable access to safe drinking water by the year 2015 (Dungumaro, 2007).The issue of water demand and supply may be explained according to the theory of co-evolution comprised of the policy system which produces supply and the household system which produces demand. Demand and supply are inter-related through positive feedbacks. After a major surface water project is completed, supply capacity exceeds demand and there is a strong economic incentive to utilities to set price to cover only the operating costs. Low water prices instigate consumption, and as consumption increases and reaches the limit of supply, there is a positive feedback to the policy system to expand supply. Continued feedbacks between the policy and household systems result in perpetual urbanization and growth of water consumption (Kallis, 2010).

Household water demand forecasts are difficult to make partly because of the general lack of empirical data on domestic water consumption. A range of socio-economic and demographic variables determine household water demand levels. Obvious variables such as occupancy and subtle ones such as occupant age determine the demand for water by households (Fox *et al.,* 2009). The purpose of the study was to characterize the households in the Luvuvhu-Letaba Water Management Area (WMA) and to investigate their water supply with a focus on sources, proximity of sources to residential sites and quantity fetched. The study will also assess the water requirements of the households and will compare them with the quantity fetched to determine the adequacy of the supply.

2. Methodology

2.1 Description of study area

The study was based on the Giyani, Mutale and Thulamela municipalities under the Luvuvhu-Letaba WMA of South Africa. The Giyani Municipality is under the Mopani Water Services Authority (WSA) while Mutale and Thulamela are under the Vhembe WSA. Specific villages selected for the study in each of the municipalities were Siyandani, Makosha and Muyexe in Giyani; Sigonde, Makwilidza, and Lukau in Mutale; and Mavunde, Djilongo, Xigamani, and Dopeni in Thulamela (Figure 1).

2.2 Sampling frame and sampling procedure

Selection of representative samples requires correct determination of sampling frames. Unless a sampling frame is borne in mind, it is impossible to properly judge the representativeness of the obtained sample (Welman *et al.,* 2005) and the trustworthiness of the subsequent results (Leedy and Ormrod, 2010). Multistage sampling was conducted as described by Leedy and Ormrod (2010) and involved primary area selection of municipalities, location selection of villages and housing unit selection of households. For area selection of municipalities, the sampling frame was composed of the five municipalities that were representative of the Luvuvhu-Letaba WMA, namely: Letaba and Giyani which were contained in the WMA and Mutale, Thulamela and Tzaneen with larger portion of land area within the WMA (Tshikolomo *et al.,* 2009). Three municipalities were purposively sampled for their accessibility with lesser transport costs, and those were Giyani, Mutale and Thulamela.

As for location selection of villages, the sampling frame was composed of 413 villages of which 85 were in Giyani, 118 in Mutale and 210 in Thulamela Municipality. From this sample frame, ten villages were randomly sampled for the study (section 2.1; Figure 1). Although Dopeni is on the little portion of Thulamela that is outside the WMA, it was included in the study because of its severe challenge of shortage of water supply. For households, the sample frame and randomly selected sample sizes (10% of sample frame) for villages selected for the study were: Siyandane – 521, 52; Makosha – 524, 52; Muyexe – 476, 48; Sigonde – 152, 15; Makwilidza – 108, 11; Lukau – 324, 32; Mavunde – 389, 39; Djilongo – 581, 58; Xigamani – 567, 57; and Dopeni – 1025, 103. The total sample frame was 4667 with a total sample size of 467.

2.3 Data collection and analysis

Data was collected from the 467 sampled households through interviews which were conducted by trained enumerators using a structured questionnaire. The questionnaire contained both open- and closed-ended questions which included household socio-economic questions as well as those on water supply and demand. As revealed by Leedy and Ormrod (2010), the closed-ended questions collected quantitative data while the open-ended questions recorded qualitative data. This research method that combines the collection and analysis of quantitative data with that of qualitative data is referred to as a mixed study (Hurmerinta-Peltomaki and Nummela, 2006).

The inclusion of open-ended questions was to enable respondents to speak for themselves, voice the constraints they faced, articulate their own accounts of what their routines were and how they satisfied their family's needs. The data was captured in MS Excel Package and analyzed statistically using the SAS Package (SAS, 2009). The Proc FREQ of SAS was used to generate simple frequency tables for each variable of interest. Selected data was summarized in Excel Spreadsheet.

3. Results and discussion

3.1 Characterization of households

3.1.1 Age of heads of household

Keshavarzi *et al.* (2006) revealed that there was a significant relationship ($r=0.17$, $p<0.05$) between head of household's age and the amount of water consumed by the household. This could be a result of attitudes toward environmental issues where older individuals possess less information about and give less attention to water conservation. Schleich and Hillenbrand (2009) argued that the cause of the increase of water consumption with age may be the fact that retired people spend more time at home and are likely to use water more frequently, or because health reasons may force older people to use the bathroom more frequently. The profiles of heads of household in the study area with regard to age are presented in Table 1.

Table 1 shows Giyani to be the only municipality that had child heads of household (4% under 18 years) and these could be orphans. The municipality also had the most heads of household (28.5%) aged 19-35, suggesting the population there to be more youthful. Mutale had the most heads of household in the middle ages (36-50) with close to half (48.2%) of them belonging to this category. Thulamela on the other hand had most (17.6%) household heads under retirement age (>65 years).

The distribution of heads of household in the study area was such that the least were children (1.3% <18) with the number increasing through youth (23.3% aged 19-35) to the middle aged (34.8% aged 36-50). Thereafter the number declined through the elderly (26.6% aged 51-65) to those of retirement age (14% aged > 65). According to Schleich and Hillenbrand (2009), the 14% of households with heads on retirement would consume more water and these were more in Thulamela.

3.1.2 Size of household

The quantity of water used increased with an increase in the number of people living in a household. However, the increase in water use was less than proportional to the increase in household size (Arbues *et al*, 2003 and Keshavarzi *et al.*, 2006). The relationship between household size and *per capita* water consumption was further articulated by Schleich and Hillenbrand (2009) who revealed that *per capita* water consumption decreased as the number of household members increased. This was said to be a result of the fact that several water uses such as laundry, gardening or even preparing food increased less than proportional to the increase in household size. As stated by Schleich and Hillenbrand (2009), an increase in the number of household members by 50%, i.e. from two to three, raised *per capita* water demand by 22%.

An investigation of the sizes of households is therefore important to obtain an idea of water consumption by the households. Mazvimavi and Mmopelwa (2006) revealed that household sizes in villages in Botswana varied from 1 to 10 persons in both gazetted and ungazetted settlements. Household sizes in the Luvuvhu-Letaba WMA were as presented in Figure 2. One in five (20%) households in the study area had one member each with Mutale having the most (22.6%) and Giyani the least (17.9%) number of households in this category. Communities in this area still attach value to a self sustaining family where members perform different roles and complement each other, and it is uncommon to have households with one member each. The persons who stayed alone could be the widowed or divorced who did not have children or those whose children could have relocated because of work or other socio-economic demands. There could also be cases where a child remained orphaned when parents passed on, more so in Giyani where child heads of household where reported.

Some 45% of households had two members each with most (49.1%) of those in Mutale and least (41.1%) in Giyani. These could be youthful families who did not have children yet or those affected by death, divorce, separation, or relocation. About a quarter (26.1%) of the households had three members each. Mutale which had the most households with one member and those with two members each had the least households (18.9%) for this group. The largest household was reported to have only four members where 8.9% of households were of this size and were most (13.3%) in Giyani and least (6.1%) in Thulamela.

With this maximum membership, households in the study area could be described as very small compared to those of villages in Botswana that had up to 10 members each (Mazvimavi and Mmopelwa, 2006). According to Stats SA (2009), the household size of four would be an average for the study area and not the maximum. For some reason, the respondents could have reported fewer members of households than the actual figures and this resulted in this impression that the households were small. For purposes of water services planning, the sizes of households should be assumed to average four as reported by Stats SA (2009).

3.1.3 Household income

Household income is a strong determinant of the supply and use of water. It was argued that people could be water poor not because there is no safe water in their area but because they are income poor. In other words, despite water being available within their area, people may fail to get connected and access safe water because they cannot afford the cost of doing so (Dungumaro, 2007).

According to Dungumaro (2007), 99.7% of households that belonged to a poor category in South Africa obtained water from unsafe sources. For the middle income category, a lesser number of 56.8% obtained water from unsafe sources while the rich category had no household obtaining water from those sources. The pattern observed in this analysis was that the number of households depending on unsafe water sources increased with the level of poverty.

Questions about income are not always welcomed by respondents. As a result, estimates of household income could be made on the basis of types and quantities of products consumed by the households (Olvera *et al.,* 2008). As an attempt to increase the quality of responses, respondents were asked to only indicate the income categories as opposed to specific incomes. The monthly incomes of the households in the study area are presented in Table 2. Some respondents (7.4%) did not provide information even when they were asked to only indicate the income categories, and those were mostly in Giyani where 15.7% did not disclose their incomes. Two in five (41.1%) households almost evenly distributed across municipalities earned R0-R1000 per month. Those could be households that depended mainly on casual jobs and those reliant on social grants, especially child support paying R250 and disability paying R750 per person per month for the 2010-11 tax year. The same number (40.4%) of households had monthly incomes of R1001-R5000 with most (47%) of them located in Thulamela. The old age grant was the most paying at R1080 per month and therefore some of these households could be reliant on those grants.

Based on a United Nations poverty line of US$1.25 *per capita* per day (World Bank, 2008) at a US$ **:** Rand exchange rate of 8, the poverty threshold income in the study area will be R10 *per capita* per day or R1 200 per four member household per month. Based on this information, the 41.1% of households with monthly incomes of R0-1000 will all be poor with some of those with monthly income of R1001-R5000 also falling in this category. In the absence of government interventions on water supply, the households will generally not afford to pay for water and according to Dungumaro (2007) will rely a lot on unsafe water sources.

3.1.4 Size of house owned

Ownership of assets has strong links with the economic well being of households. An inverse relationship was recorded between ownership of assets and poverty, implying that poverty can be alleviated by increasing people's asset base (Fox *et al.,* 2009 and Erenstein *et al.,* 2010). A house is an important asset for any household and its size determines the economic status and subsequently the supply and use of water by the household. The sizes of houses owned by households in selected municipalities in the Luvuvhu-Letaba WMA are presented in Table 3.
Table 3 shows that 4.8% of the households had only one room each. This room would be used as a kitchen, dining, lounge and bedroom, reflecting a desperate state of lack of housing accommodation and indeed of poverty. One in eight (12.2%) households had two room houses and that still suggested shortage. Most (14.9%) households with one and two room houses were in Thulamela, implying severe lack of housing development in this municipality. The majority of houses were 3-4 rooms in Mutale and 4-5 rooms in both Giyani and Thulamela. Some households (29.5%) in the study area had bigger houses with more than five rooms. Some houses were built for the communities by government under its Reconstruction and Development Programme (RDP) at no cost to occupants. The sizes of houses owned by households in the study area could therefore not be a reliable indicator of their economic status. The results on characterization of households reveal that most heads of household (34.8%) were middle aged (36 -50).

Households were reportedly very small with most (45.0%) having two members and the largest having four members with the latter size adopted for water resource planning. Households were mostly in the income groups of R0-R1000 per month (41.1%) and R1001-R5000 per month (40.4%) and this revealed a severe state of poverty. Most families owned houses of 3-5 rooms and these were mainly built by government for the poor at no cost to the users. The poor socio-economic conditions of the households in the study area implies that they may not afford to pay for improved water services.

3.2 Household water supplies

3.2.1 Water sources and their safety

The quality of water fetched is influenced by the safety of the sources used and is dependent on the economic status of the household. Poor households in South Africa obtained water from less safe sources of wells, vendors or kiosks while wealthier residents had safer piped connections (Goldblatt, 1999, Aiga and Umenai, 2002, Manase *et al.,* 2009). Table 4 shows household water sources in the area under study enlisted from unsafe to safer sources. Some 2.7% of households still obtained water from unsafe rivers with most (5.2%) of these located in the water scarce Giyani Municipality (Table 4). Fewer (1.4%) households relied on less safe wells for water. Some 5.7% of the households bought water from neighbours again with most (16.5%) of them residing in Giyani, and the safety of such water would depend on the primary source. Up to 15.8% of the households relied on fairly safe boreholes for water with most (21.3%) located in Thulamela Municipality. Although truck delivery was not an important source, its safety would also depend on the primary source of the water. Half (50.1%) of the households obtained water from the safer street taps supplying treated water with most (83.9%) of them located in Mutale and least (33.0%) in Giyani. Combinations of sources supplied 24% of households with water and might have been unsafe or safer depending on the sources used at any time.

The fact that safe water sources of street taps and fairly safe boreholes were common in the study area suggests that some public investment was made in water infrastructure. This intervention was necessary for the poor community to access safe water; else they would not afford to pay for access to the resource. The development of water infrastructure in an area would depend on availability of water resources. Giyani was highly limited in water resource availability and therefore little infrastructure could be developed. The supply of quality water still needs to be improved in all the municipalities, and this requires availability of the resource. Tshikolomo *et al.* (2009) revealed that rivers in this WMA were already much exploited in terms of construction of dams, and little opportunities would be available for further development of the storage infrastructure. An exception was the Mutale River as it was strongly flowing with catchment mean annual runoff of 157.1 million m^3 and had small storage capacity of only 3.9 million m^3. The Department of Water Affairs (DWA) should explore opportunities for construction of a new dam on this river together with a water treatment facility. The department should also do more scoping for underground water and drill more community boreholes where possible.

3.2.2 Distance of water source from residential site

The distance of water sources from residential sites was influenced by the level of social and economic development of a community. The distance generally shortened with more development (Makoni *et al.,* 2004). The distance of water sources from residential sites in the study area is shown in Figure 3.

Water sources were located within 0-1 km from residential sites of 46.7% of the households in the study area (Figure 3). The water sources within 0-1 km of residential sites were more (53%) in Thulamela and fewer in the other municipalities and could be mostly street taps. The water sources were located within 1-2 km from residential sites of 17.9% of the households. These sources were also more (20.9%) in Thulamela and fewer (8.9%) in Mutale. The sources located in this distance could be mainly boreholes as these were reported by more (21.3%) households in Thulamela and by fewer in other municipalities (Table 4).

Less than half (46.7%) of the households in the study area used water sources located within a distance of 1 km from the residential sites. Water sources were mostly located more than 1 km away from residential sites of the majority of the households. According to Mazvimavi and Mmopelwa (2006), the water sources located more than a kilometer from residential sites as was the case here might be considered inaccessible and would adversely affect the *per capita* volume of water used to satisfy basic personal hygiene. The Mopani and Vhembe WSAs should develop more reticulation infrastructure to improve access of water in the study area.

3.2.3 Quantity of water fetched

Literature with information on how much water is supplied to a household is very limited (Whittington, 2002). The volume of water collected by a household in ungazetted settlements in Botswana varied from 20 to 400 liters with an average of 100 liters per day. The supply of water to some households in Botswana made provision of less than 20 litres *per capita* per day, and with this provision, basic personal and food hygiene requirements for water could not be satisfied (Mazvimavi and Mmopelwa, 2006). Table 5 presents the supplies of water to households in the study municipalities of the Luvuvhu-Letaba WMA. Some 7.4% of households in the study area fetched a maximum of 25 litres of water per day with 10.5% located in Giyani, 16.1% in Mutale and 4.6% in Thulamela (Table 5). One in nine (11.3%) households fetched 26-50 litres per day with Mutale being home to 45.2% of them. Mutale had the most (83.9%) households supplied from street taps (Table 4) and those could be closer to residential units, and yet it had the highest numbers that fetched lesser quantities of 0-25 and 26-50 litres per day.

The lesser amounts fetched could have resulted from the fact that the municipality had smaller households where 22.6% had one and 49.1% had two members (Figure 2). With more street taps in the municipality, households could have connected own pipes to convey water to their yards where uses such as crop watering would be catered for directly without the water having to be stored in containers. Only water for important uses such as drinking and cooking would be stored in containers and would accordingly be reported as water fetched and this would result in the impression that households in the municipality fetched lesser amounts of water. Most households (24.2%) fetched 51-75 litres per day with 32.5% in Giyani, 19.4% in Mutale and 20.5% in Thulamela. Some 8.8% of households fetched 76-100 liters while 16.8% fetched 101-150 liters of water per day. Some 10.4% of households fetched 151-200 litres while 21.2% had daily quantities of water in excess of 200 liters with most of them (24.7%) in Thulamela followed by Giyani (18.4%) and least (6.5%) in Mutale. Such households had water supplies exceeding double the recommended minimum of 25 litres *per capita* per day for a four person household (RSA, 1994).

The results indicate that half (51.7%) of the households fetched ≤ 100 litres of water planned for a four member household per day and this affirms the need for improvement of water supplies in the study area to ensure adequate provision for all households. The prospects for constructing a dam in the currently under-utilized Mutale River should be considered. The new Nandoni Dam in Thulamela should improve supplies in the municipality and other needy areas with planned transfers to Nsami Dam likely to address the scarcity in Giyani.

3.2.4 Influence of distance of water sources from residential sites on quantity fetched A study of household water consumption in Nicaragua revealed that a decrease in the distance to the water source from 1000m to 10m was associated with an increase in *per capita* water consumption of 20% (Keshavarzi *et al.*, 2006). This view was affirmed by Katsi *et al.* (2007) who stated that water sources nearer to residential sites provided respondents with easy access to water, making it possible for the households to fetch more water. The influence of distance of water sources from residential sites on the amounts fetched in the study area is shown on Figure 4.

There was a medium to strong correlation (R^2=0.6988) between the distance of water sources from residential sites and the quantity of water fetched (Figure 4). As revealed by the graph (Y= -0.409 x + 28.2), the quantity of water fetched increased with a decrease in the distance of the water sources from residential sites. This affirmed Katsi *et al.* (2007) statement that water sources nearer to residential sites provided respondents with easy access to the resource. Where adequate runoff is stored, installation of reticulation pipes will reduce the distance of the water sources to residential sites and will lead to more quantities being fetched by households. The fact that there were still households that obtained water from unsafe sources such as rivers and wells suggest a serious challenge with regards to the supply of the resource. The occurrence of the challenge was affirmed by the long distance (> 1 km) travelled by the majority of the households to fetch water, and this resulted in less water being fetched. The quantity of water fetched by the households declined when the distance of water source from residential site increased. This implied that installation of more reticulation infrastructure would result in increasing quantities of the resource fetched and this would result in improvement of the socio-economic condition of the rural communities. The availability of street taps for 50.1% and boreholes for 15.8% of households reveals that some work is under way to address the supply challenge.

3.3 Household water uses

3.3.1 Water use activities

Rural households use water for both indoor and outdoor activities.

Indoor water uses include consumption for drinking, preparing food and hygiene activities such as bathing and laundry (Merrett, 2002; Keshavarzi *et al.,* 2006; Katsi *et al.,* 2007). Outdoor activities include car washing, livestock drinking and garden watering (Arbues *et al.,* 2003; Keshavarzi *et al.,* 2006). Also, water use in rural areas may be classified into basic household and productive uses. Basic household uses refer to water used for drinking, preparing food and personal hygiene. Productive consumption on the other hand highlights economic activities that are highly dependant on availability of water supplies, namely vegetable gardens, animal drinking, traditional beer making and brick making (Makoni *et al.,* 2004; Mazvimavi and Mmopelwa, 2006). The uses of water by households in the study municipalities of the Luvuvhu-Letaba WMA are presented in Table 6.

Table 6 reveals that the majority of households in the study area used water for basic as opposed to productive consumption. The basic household activities reported to have consumed water were drinking by people (95.9% of households), preparing food for home consumption (95.4%), bathing (92.8%) and laundry (90.8%). Most households were reported to have used water for these activities in Thulamela followed by Mutale and Giyani. These activities are the basic requirements for life and it would therefore be expected for all households to have allocated some water to them. The impression that certain households did not use water for some of these activities is incomprehensible, more so for drinking by people and preparing food and this could have been exaggeration of the water scarcity by some respondents.

Fewer households used water for productive activities and this confirmed the scarcity of the resource in the study area. The Mutale Municipality was reported to have used more water for productive purposes than Thulamela and Giyani. Water supply for the productive activities such as car washing and crop watering could have been sourced through connecting own pipes to street taps by the 83.9% of households who relied on these taps (Table 4). Such water might not have to be stored in containers and would not be measured, hence the households in the municipality would report having fetched lesser quantities of water (Table 5). After Mutale, more households sourced water from street taps in Thulamela than those in Giyani, and accordingly more households used the resource for productive purposes in Thulamela compared to Giyani. Improving access to water would increase the use of the resource for productive activities in all municipalities and would trigger growth of the rural economy.

3.3.2 Quantity of water required by households

There is a dearth of reliable information on quantity of water required by households for different purposes (Merrett, 2002). In Mvunyane village in South Africa, 43% of households used less than 50 litres and a further 49% used between 50 and 100 litres of water per day. With the average household size in Mvunyane being five people, the average quantity of 15 liters of water used *per capita* per day was far less than the design standard of 25 litres *per capita* per day (RSA, 1994 and Goldblatt, 1999). Households in the study area had no metered connections and that made it difficult to have accurate figures of the quantities of water they used. Whittington *et al.* (2002) revealed that even villages with household connections could lack or have broken meters making it difficult to estimate precisely how much of the water supplied actually reaches the customers. As stated by Whittington *et al.* (2002), households with connections could also use alternative sources of water such as wells and public taps which would complicate calculation of the amount of water consumed. It was for this reason that this study accepted estimates of the quantities of water required as provided by respondents. Table 7 presents the daily amounts of water needed by household in the study municipalities of the Luvuvhu-Letaba WMA.

As presented in Table 7, the majority of respondents estimated the household water requirements to be 0-25 litres each for drinking (95.6% of households), cooking (91.5%) and bathing (63.1%). Laundry was reported by most households (43.6%) to require more than 50 liters per day and this could be estimated at 75 litres based on the fact that a 25 litre container is commonly used to fetch water. The requirement of more than 50 litres could mean one or more additional containers. Based on these results, a household would require 150 litres of water per day. The 150 litre household water budget could be under- or over-estimated and would require comparison with results of related studies before acceptance.

The ideal amount of water required *per capita* per day was estimated at 1.7 (Ershow and Cantor, 1989) to 2 litres (WHO, 1996) for drinking, 10 to 20 litres for cooking (Inocencio *et al.,* 1999), 5 to 15 litres for bathing (Gleick, 1996) and 8 to 10 litres for laundry (Dangersfield, 1983). This makes a lower estimate total water requirement of 24.7 and a higher estimate total requirement of 47 litres *per capita* per day suggesting an average requirement of 35.85 litres *per capita* per day. The average water requirement for a four member household is therefore estimated at 143.4 litres and is very close to the 150 litres reported by the respondents.

The estimate water demand of 150 litres per day reported for households in the study area may therefore be regarded as credible for an average household. Rural households are currently supplied based on design standard of 25 litres *per capita* per day (RSA, 1994) and for the average household of four members this translates to 100 litres per household per day. Supplies of 150 litres per household would provide 37.5 litres *per capita* per day. The current design standard for rural water supply is therefore less than the requirement presented by respondents by 50 litres per household per day or 12.5 litres *per capita* per day. The scarcity of water supply results in the resource being used mainly for basic domestic activities.

4. Conclusions

Heads of household were mostly in the middle ages of 36-50 (34.8%) years old. Households were poor with low monthly incomes of R0-R1000 for 41.1% and R1001-R5000 for 40.4% of the families. The study area has a scarcity of water supply exacerbated by the dearth of infrastructure for its reticulation. Half (50.1%) of households obtained water from street taps and 46.7% had good access to water sources with elderly households having better access than their youthful counterparts. The quantity fetched was widely variable, 7.4% of households fetched 0-25 litres and 21.2% fetched > 200 litres per day. Households that are located nearer to water sources fetched more water than those away from the sources.

As a result of the scarcity of the water supply, more households only used water for basic activities such as drinking (95.9%), preparing food (95.4%) and bathing (92.8%) compared to those who used it for productive activities such as washing cars (6.6%) and watering crops (5.7%). Half (51.7%) of the households fetched less water than the 25 litres *per capita* per day supply standard. Analysis of the requirements revealed that the 25 litres *per capita* per day did not meet the average requirement of 37.5 litres *per capita* per day. This scarcity of water supply could be among the causes of the poor socio-economic conditions of the rural communities.

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6. Figures and Tables

6.1 Figures

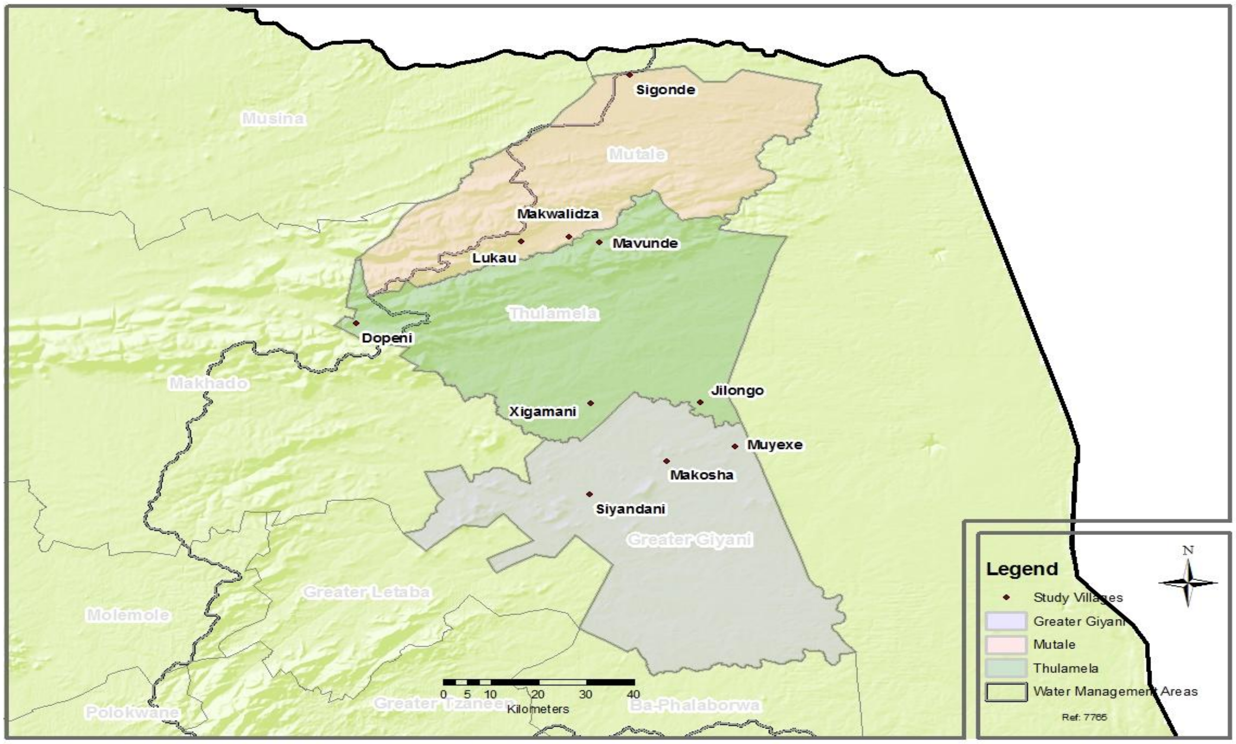

Figure 1. Map of Luvuvhu-Letaba WMA showing the location of the study municipalities and villages

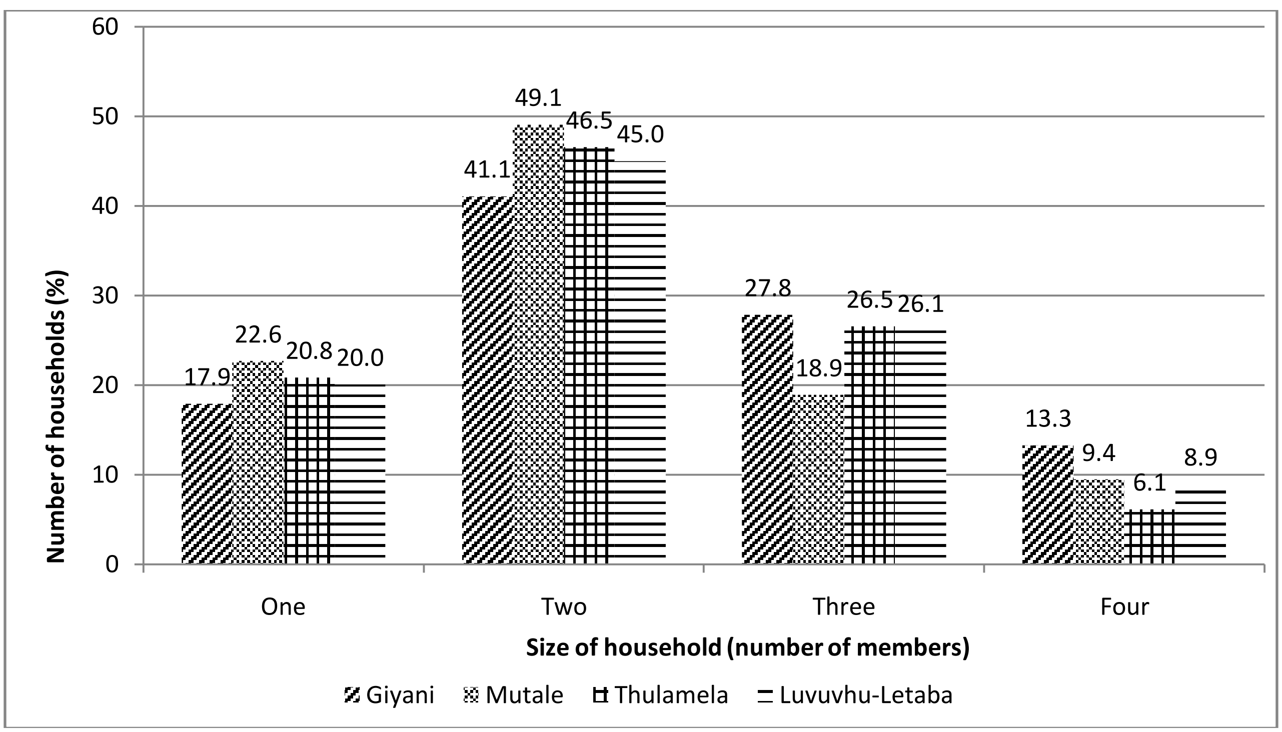

Figure 2. Distribution of households in study municipalities in the Luvuvhu-Letaba WMA according to their sizes

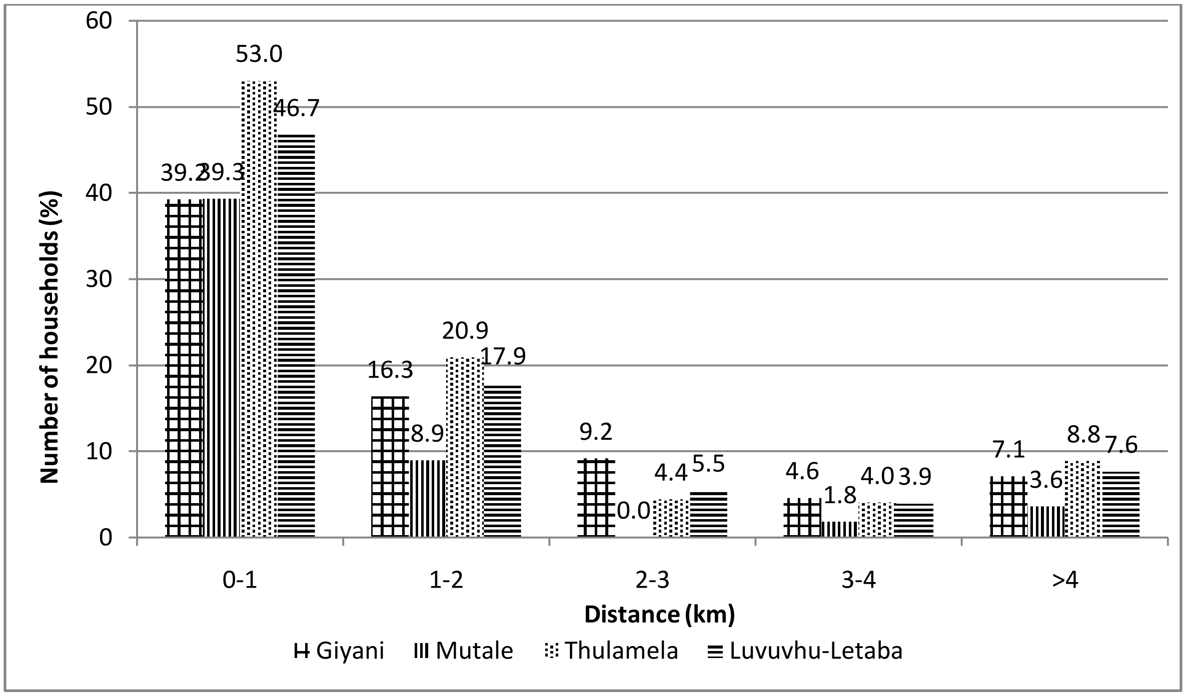

Figure 3 Distribution of households in study municipalities of the Luvuvhu-Letaba WMA according to the distance of water source from residential sites

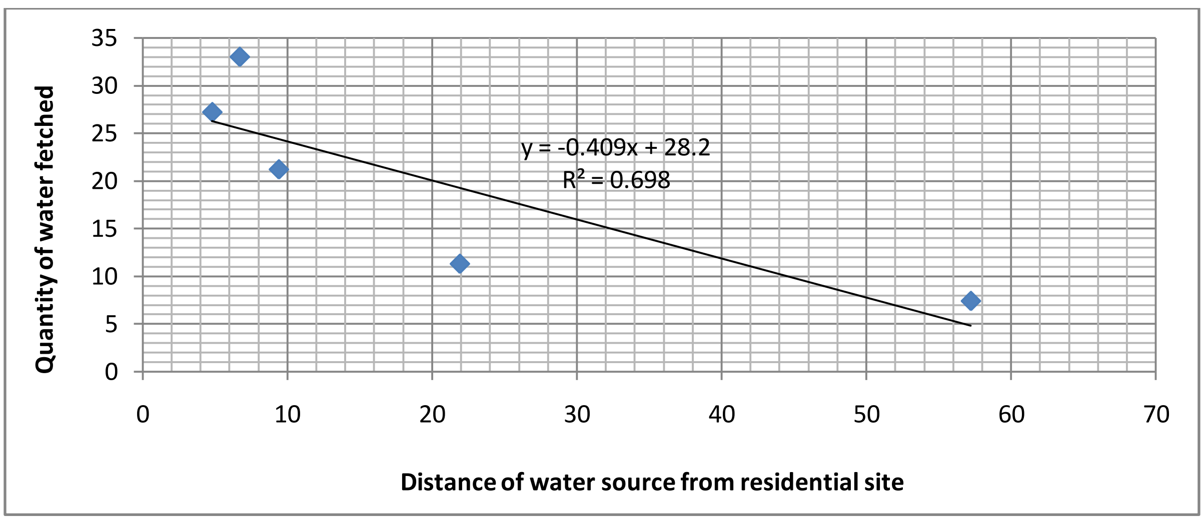

Figure 4 Influence of distance of water source from residential site on quantity fetched

6.2 Tables

Table 1.Distribution of heads of household in the study municipalities under the Luvuvhu-Letaba WMA according to age

	Giyani		**Mutale**		**Thulamela**		**Luvuvhu-Letaba WMA**	
Age	f	%	f	%	f	%	f	%
< 18	6	4	0	0	0	0	6	1.3
19 - 35	43	28.5	7	12.5	55	22.5	105	23.3
36 - 50	49	32.5	27	48.2	81	33.2	157	34.8
51 - 65	37	24.5	18	32.1	65	26.6	120	26.6
> 65	16	10.6	4	7.1	43	17.6	63	14
Total	**151**	**100**	**56**	**100**	**244**	**100**	**451**	**100**

Table 2.Monthly incomes of households in the study municipalities of the Luvuvhu-Letaba WMA

	Giyani		Mutale		Thulamela		Luvuvhu-Letaba WMA	
Income	**f**	**%**	**f**	**%**	**f**	**%**	**f**	**%**
No response	24	15.7	0	0.0	10	4.0	34	7.4
R0 - R1000	64	41.8	25	44.6	99	39.8	188	41.1
R1001 - R5000	48	31.4	20	35.7	117	47.0	185	40.4
R5001 - 10 000	12	7.8	9	16.1	17	6.8	38	8.3
> R10 000	5	3.3	2	3.6	6	2.4	13	2.8
Total	**153**	**100.0**	**56**	**100.0**	**249**	**100.0**	**458**	**100.0**

Table 3.Sizes of houses owned by households in study municipalities in the Luvuvhu-Letaba WMA

Number of rooms	Giyani		Mutale		Thulamela		Luvuvhu-Letaba WMA	
	f	**%**	**f**	**%**	**f**	**%**	**f**	**%**
1	3	2.0	3	5.4	16	6.4	22	4.8
2	15	9.8	4	7.1	37	14.9	56	12.2
3	13	8.5	14	25.0	39	15.7	66	14.4
4	35	22.9	11	19.6	52	20.9	98	21.4
5	25	16.3	9	16.1	41	16.5	75	16.4
6	16	10.5	6	10.7	23	9.2	45	9.8
7	20	13.1	6	10.7	15	6.0	41	9.0
>7	25	16.4	3	5.4	21	8.4	49	10.7
Total	**152**	**99.4**	**56**	**100.0**	**244**	**98.0**	**452**	**98.7**

Table 4.Sources of water for households in the study municipalities of the Luvuvhu-Letaba WMA enlisted from unsafe (1) to safer (6) sources.

Water source	Giyani		Mutale		Thulamela		Luvuvhu-Letaba WMA	
	f	**%**	**f**	**%**	**f**	**%**	**f**	**%**
1. River	6	5.2	1	3.2	3	1.4	10	2.7
2. Well	1	0.9	0	0.0	4	1.8	5	1.4
3. Buy	19	16.5	0	0.0	2	0.9	21	5.7
4. Borehole	11	9.6	0	0.0	47	21.3	58	15.8
5. Truck delivery	0	0.0	1	3.2	0	0.0	1	0.3
6. Street tap	38	33.0	26	83.9	120	54.3	184	50.1
7. Combinations	40	34.8	3	9.7	45	20.4	88	24.0
Total	**115**	**100.0**	**31**	**100.0**	**221**	**100.0**	**367**	**100.0**

Table 5.Distribution of households in the study municipalities of the Luvuvhu-Letaba WMA according to quantity of water fetched

Quantity of water fetched (*litres per day*)	Giyani		Mutale		Thulamela		Luvuvhu-Letaba WMA	
	f	%	f	%	f	%	f	%
0 - 25	12	10.5	5	16.1	10	4.6	27	7.4
26 - 50	10	8.8	14	45.2	17	7.8	41	11.3
51 - 75	37	32.5	6	19.4	45	20.5	88	24.2
76 - 100	15	13.2	0	0.0	17	7.8	32	8.8
101 - 150	11	9.6	1	3.2	49	22.4	61	16.8
151 - 200	8	7.0	3	9.7	27	12.3	38	10.4
> 200	21	18.4	2	6.5	54	24.7	77	21.2
Total	**114**	**100.0**	**31**	**100.0**	**219**	**100.0**	**364**	**100.0**

Table 6.Distribution of households in study municipalities of the Luvuvhu-Letaba WMA according to uses of water for basic household and productive activities

Water use	Giyani		Mutale		Thulamela		Luvuvhu-Letaba WMA	
Basic household	f	%	f	%	f	%	f	%
1. Drinking by people	141	92.2	52	92.9	246	98.8	439	95.9
2. Cooking for home consumption	141	92.2	52	92.9	244	98.0	437	95.4
3. Bathing	134	87.6	52	92.9	239	96.0	425	92.8
4. Laundry	130	85.0	46	82.1	240	96.4	416	90.8
Productive								
5. Washing car	5	3.3	9	16.1	16	6.4	30	6.6
6. Irrigating crops	2	2.6	8	16.1	7	5.2	17	5.7
7. Livestock drinking	1	0.7	6	10.7	9	3.6	16	3.5
8. Cooking food for sale	0	0.0	0	0.0	3	1.2	3	0.7
9. Brewing drinks for sale	0	0.0	0	0.0	8	3.2	8	1.8

Table 7. Distribution of households in the study municipalities of the Luvuvhu-Letaba WMA according to their daily water requirements for different uses

Specific water use	Quantity of water needed (*litres*)	Giyani		Mutale		Thulamela		Luvuvhu-Letaba WMA	
		f	%	f	%	f	%	f	%
Drinking	0 - 25	149	97.4	53	94.7	236	94.8	438	95.6
	26 - 50	4	2.6	2	3.6	13	5.2	19	4.2
	> 50	0	0.0	1	1.8	0	0.0	1	0.2
Cooking	0 - 25	143	93.5	53	94.7	223	89.6	419	91.5
	26 - 50	8	5.2	3	5.4	26	10.4	37	8.1
	> 50	2	1.3	0	0.0	0	0.0	2	0.4
Bathing	0 - 25	95	62.1	43	76.8	151	60.6	289	63.1
	26 - 50	35	22.9	6	10.7	57	22.9	98	21.4
	> 50	23	15.0	7	12.5	41	16.5	71	15.5
Laundry	0 - 25	93	60.8	34	60.7	65	26.5	192	42.3
	26 - 50	17	11.1	13	23.2	34	13.9	64	14.1
	> 50	43	28.1	9	16.1	146	59.6	198	43.6