

PUBLIC PARTICIPATION IN NON-REVENUE WATER MANAGEMENT: A CASE OF NAMIYANGO AND CHIGUMULA, BLANTYRE

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ABSRACT:

High Non-Revenue Water (NRW) rates still remain high in most water utility companies despite various technical solutions such as pipe, meter replacement and pressure management. This study assessed public participation in NRW management and their perception towards NRW management to uncover public knowledge, concerns and action towards NRW reduction. Descriptive survey research design was used to collect data to answer questions concerning public participation in NRW management. The study used purposive sampling technique to select study areas, Namiyango and Chigumula, and simple random sampling to select respondents. A sample size of 86, 43 Chigumula and 43 Namiyango, was determined for the study. Questionnaires and one on one discussions were used to collect data which was analysed qualitatively and quantitatively. Results showed that the majority of the respondents from Chigumula (81.6%) and Namiyango (62.2%) have the knowledge of NRW, deem that both the public and individuals have responsibility in NRW reduction. Water loss through pipe leaking or burst at the road, water loss through meter inaccuracy at home and water loss through Illegal pipe connection were major public concerns in Namiyango and Chigumula as they were either very serious or somewhat serious problems. Despite the concerns, only a very few reported water loss issues to Blantyre Water Board (BWB). This is implicated to the process for making such a report and the majority not having BWB hotline.

Key words: Public participation, Non-Revenue Water, leakage, burst pipes

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ACRONYMS/ABBREVIATIONS

BWB	Blantyre Water Board
NRW	Non-Revenue Water
NRWL	Non-Revenue Water Loss
MWA	Malaysian Water Association
WDS	Water Distribution System
GoM	Malawi Government
DMA	District Metered Area

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1 CHAPTER 1: INTRODUCTION

1.1 Background

The concept of Non-Revenue Water (NRW) is not new in literature. In fact, it came about due to the realisation that public utilities were making losses from the sales of treated water against its production volume. Understanding water loss was a challenge for many utility companies as they did not have a best clue on how they can accurately calculate the amount which was not accounted for. Until International Water Association (IWA) came in with the right definition, calculation on Non-revenue water, brought different and confusing results (USAID, 2015). According to International Water Association NRW is simply to know how much water is lost as leakage from the network ('real' losses), and how much is due to 'apparent' or non-physical losses against system production (Jang, 2018). Even though water utilities are currently able to manage some of the NRW issues through different strategies (Fanner, 2004; Jang, 2018; Rizzio et al., 2004), NRW issues are currently a big challenge in developing countries as NRW rates keep on increasing. One of the reasons as to why these water utilities are facing high rates of NRW is poor awareness of the public by water utility providers on issues of NRW and how they can take initiative to reduce the current rate.

Like in many African countries, high NRW is also experienced in Malawi's major cities of Blantyre and Lilongwe. The access to water in the cities is affected by unreliable and intermittent water supply due to deterioration of water infrastructure (Mughogho & Kosamu, 2012), poor revenue collection by the utility providers (Kalulu & Hoko, 2010; Manda, 2009), high levels of unaccounted water (Non-Revenue Water) (Harawa et al., 2016) and rising urban population (Mpakati-gama & Mkandawire, 2015). According to Nkawihe (2021), NRW is one of the major problems the five water utilities in the country are facing namely Blantyre Water Board, Central Region Water Board, Lilongwe Water Board, Northern Region Water Board and Southern Region Water Board. The percentage for NRW in the utilities is ranked between 30-54%, which is costing Malawi MWK35 billion each year (Nkawihe, 2021). In order to reduce NRW, Blantyre Water Board (BWB), a sole water supplier in Blantyre city has been working hard in upgrading the existing water

distribution system by building water reservoirs, installing of new pipes, introducing new meters, establishing a call free number for faults and sensitising the public on vandalism of water infrastructures and the benefits of reporting any faults or leakages (BWB, 2015). However, the NRW rates are still on the rise which interests this study to determine public participation in non-revenue water management.

1.2 Problem Statement

Despite the effort to reducing NRW issues in Blantyre City, Blantyre Water Board still encounters high NRW rates. BWB recorded high NRW of 39 percent, 37 percent, 54 percent for the years 2018, 2019 and 2020 respectively (GoM, 2020; Msowoya, 2020). As of January 2020, the board was losing money amounting to MWK1 billion monthly due to Non-Revenue Water resulting from burst pipes (Kasanda, 2020). These high NRW rates may be as a result of the failure by BWB to make public aware on NRW issues and include the public in NRW management. Therefore, a public which is aware of the importance of NRW reduction and water conservation can play a role, as informed and active citizens who report burst pipes, pipe leakage, meter malfunctions at home, suspected illegal water use, etcetera, to the responsible authorities. It is in this respect that this research will sought to understand public participation in NRW reduction while it will seek to determine public awareness of NRW reduction, their perception, actions towards NRW issues and provide alternative systems on how information should flow between the utility company and those living with water loss in Namiyango and Chigumula, Blantyre.

1.3 Study objectives

1.3.1 Main objective

The main objective of this research was to understand the public participation in Non-Revenue Water management and perception towards NRW management.

1.3.2 Specific objective

- To assess public knowledge and awareness of NRW issues and NRW reduction
- To identify public concerns and actions towards Non-Revenue Water loss
- To establish the role of the hotline and its impact on non-revenue water

1.4 Research Questions

- What is the public awareness of NRW issues?
- What is the public perception of the self-responsibility in non-revenue water/water loss reduction?
- What is the public's perception of the stakeholder's responsibility in reducing NRW/water loss?
- What is the public's concerns and action towards NRW or water loss reduction?
- What are the existing means to reducing water loss or NRW?

1.5 Significance of the study

The study sought to provide important information to policy makers on the status of NRW or water loss issues in the area. The information would be relevant as it would help policy makers to revise their non-revenue water management strategies that will be in line with the Sustainable development goal number six (SDG). The study also revealed how the public participates in NRW reduction, public concern with the water loss and actions taken to address the situation in their area. The study also provided substitute methods and strategies to deal with water loss in the district. To the body of knowledge, the study added data on the importance of public knowledge on NRW reduction strategies.

2 CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This section provides information on the similar studies that have been conducted in the field of Non-Revenue Water management and water governance. The section incorporated local and international knowledge to address the

2.2 Defining Non-Revenue Water in water distribution system (WDS)

The concept of Non-Revenue Water (NRW) is not new in literature. Different authors have come up with almost similar definitions in order to accurately determine how much water is lost before it reaches the customer. According to Kingdom et al. (2006), Non-revenue water is the difference between the volume of water put into a water distribution system and the volume that is billed to customers. Jang (2018) added an element to Kingdom et al., definition by stressing that NRW in a water distribution network is the water lost from unbilled authorized consumption, apparent losses, and real losses compared to the total system input volume. Saldarriaga et al. (2010), argued that NRW corresponds to water loss due to leaks, commercial problems, and non-billed consumption such as a lack of water meter precision or mistakes in client databases. Since all the definition almost arrive at the same conclusion, this study, therefore, defines non-revenue water as water that has been produced, distributed and is lost before it reaches the customer.

NRW comprises three components: physical (or real) losses, commercial (or apparent) losses, and unbilled authorized consumption (Farley, 2003; Jang, 2018; Kingdom et al., 2006).

Physical losses comprise leakage from all parts of the system and overflows at the utility's storage tanks. They are caused by poor operations and maintenance, the lack of active leakage control, and poor quality of underground assets (Jang, 2018; Kingdom et al., 2006). Commercial losses on the other hand are caused by customer meter under registration, data-handling errors, and theft of water in various forms (Farley, 2003). While, unbilled authorized consumption includes water used by the utility for operational purposes, water used for firefighting, and water provided for free to certain consumer groups (Kingdom et al., 2006).

The components of NRW are normally determined by conducting a water balance. This is based on the measurement or estimation of water produced, imported, exported, consumed or lost - the calculation should balance. The water balance calculation provides a guide to how much is lost as leakage from the network ('real' losses), and how much is due to 'apparent' or non-physical losses (Farley, 2003). NRW was often confused with water that was billed, but the tariff could not be collected for it (JICA, 2020). However, IWA classified revenue-water (RW) and NRW based on whether the water is subject to billing. In this case, the water that was distributed and billed is classified as revenue water while the water distributed but not billed is what is called NRW as shown in Figure 1 below.

Table 1.1 Water Balance Sheet Based on IWA Definition

System Input Volume (SIV)	Authorized Consumption	Billed Authorized Consumption	Billed metered water consumption	Revenue Water
			Billed unmetered water consumption (Water meter not installed, estimated water consumption due to water meter failure)	
		Unbilled Authorized Consumption	**Unbilled metered water consumption (Settled water consumption)**	Non-revenue Water (NRW)
			Unbilled unmetered water consumption (Free water from public tap, pipeline cleaning water from water utility)	
	Water Losses (Unaccounted For Water: UFW)	**Apparent Losses (Commercial Loss)**	**Unauthorized water consumption (Unknown water, illegal connection water)**	
			Customer metering inaccuracies	
		Real Losses (Physical Loss)	**Leakage on transmission and distribution mains**	
			Leakage and overflows at distribution reservoir	
			Leakage on service connections up to point of customer metering	

Source: Management of Non-revenue Water, Shozo Yamazaki, 2011

Figure 1 Water Balance Sheet

2.3 Public participation in Non-Revenue Water management

Many water utilities companies have employed different strategies to manage NRW in Africa. However, NRW issue still remain the major problem for the water utility companies. Some of the problems that exacerbate the progress of NRW reduction in developing countries include: lack of funding, lack of motivation of water service providers, political interference, issues of corruption, and lack of private sector interest

(González-Gómez et al., 2011; Lai et al., 2017). Surprisingly, even after increasing funding in water sector, increasing incentives for workers as a motivation, reducing corruption and privatising water sectors, NRW keeps on increasing. One management area that has been overlooked is the public involvement or participation (Frauendorfer & Liemberger, 2010; González-Gómez et al., 2011). González-Gómez et al. (2011), stressed that the reasons why NRW rates cannot be effectively reduced in some cities is due to a lack of public participation in NRW reduction activities. Lai et al. (2017) cited some examples in the literature that show that public participation can contribute to better outcomes for NRW reduction programmes. They revealed that people/public in Phnom Penh, Cambodia, are encouraged to report illegal pipe connections, with rewards offered by the authority to those that do report and penalties given to those found installing illegal pipe connections. Through this initiative, Cambodia water service managed to reduce NRW rate from 68% in 1993 to only 6.19% in 2018 (Biswas & Tortajada, 2009). Public participation in NRW reduction reduced NRW rate by 45 per cent to only 16.9 per cent in 2009 in East Concession Zone of Metro Manila, Philippines. The reduction was realised when the water service providers introduced a community water management programme by engaging several local people as informal street leaders, who assisted the water service providers to curb NRW issues, by providing information on aspects such as burst pipes, leaking pipes and water shortages (Asian Development Bank, 2010). This shows that positive relationship with the public in NRW reduction management programs has greater benefit to water utility companies. Studies have also shown that involving the public in NRW reduction programs increases their awareness and Perception on NRW reduction as shown in the subheadings below.

2.3.1 Public perception on NRW reduction

A recent study by Lai et al. (2017), on understanding public perception and participation in non-revenue water management in Malaysia to support urban water policy, revealed that community water management programme increased public concern and action towards NRW Reduction. The study further revealed that the public felt concerned whenever they saw NRW-related issues and reported the matter to water utility companies. According to Lai et al. (2017), public concern and action towards NRW

reduction is only achieved when water utility companies involve public and reward them whenever they report any of the components of NRW. This study will explore perception of public on NRW reduction in Namiyango and Chigumula, Blantyre city.

2.3.2 Public awareness of Non-Revenue Water

An examination of public awareness of NRW is very important in water supply research. It can be stated that a water utility company cannot reduce the rate of NRW if the public are not well informed about issues of NRW. Lai et al. (2017), argued that public participation in NRW management can make the NRW reduction strategies more effective. The provision of information on aspects such as burst pipes, leaking pipes and water shortages to the public is seen as the best approach to reduce NRW in urban areas (Asian Development Bank, 2010). It is also reported that if people are aware of the illegal water connection, means of communicating NRW issue, they will be able to report the issues instantly (Gowela et al., 2017a). However, it is too difficult for the public to report issue they are not aware of as negative impacts of NRW issues on the public are mostly delayed or indirect, leading to poor public awareness of the issue (Lai et al., 2017). A public awareness study on NRW in Malaysia by Lai et al. (2017), found that people did not have good awareness of the NRW situation in the country. As a result, majority of the respondents did not think that leaking pipes are one of Malaysia's major water issues, and the majority of them did not rate water loss issue as either serious or very serious in Malaysia. This is similar to the situation in Malawi where you see leaking pipes not attended on or unreported leading to high NRW (Gowela et al., 2017a). Low public knowledge on the issue of NRW is characterised by lowest cases of water interruption reports. This is validated by MWA (2014), who reported lowest number of cases of water supply interruptions reported to Penang and Perlis's water service providers in 2012 and 2013 even though the water utilities experienced high NRW in the years. Lai et al. (2017), further found that lack of awareness of the public concerning NRW issues could be partially attributed to the fact that they do not understand the term NRW. Therefore, it will be very interesting to find out if people in this study have knowledge on NRW since the degree to which a person is concerned about NRW-related issues determines the action that will be taken by a person, if the issue is noticed by the person.

2.4 Benefits of NRW reduction

The goal of every water supply utility is to supply clean, ample, and affordable water, and to contribute to the improvement of public health and living environment. However, this cannot be achieved if the water which is not accounted for is not properly managed. A study by Gowela et al. (2017) on service quality gap analysis to improve portable water supply in Lilongwe city divulged that reducing NRW has positive implications on customer satisfaction as the reduction of physical loss helps increase the supply without investing in new water supply infrastructure or without limiting water usage. NRW reduction brings various benefits to water utility services, and each water utility company has different views on what benefit of reducing NRW is considered a priority (JICA, 2020). JICA, (2020), summarised benefits and significance of NRW reduction as follows:

(a) Significance and Benefits of Reducing Physical Loss

- In case the water supply is short of the demand and the supply has to be increased, the reduction of physical loss helps increase the supply without investing in new water supply infrastructure or without limiting water usage. The saved water can be supplied to the customers, billed, and contribute to increasing the revenue.
- In case the water supply is meeting the demand, reduction of leakage helps reduce the amount of water to be supplied. This reduces the operation cost, such as electricity and chemicals. Moreover, leakage reduction saves precious water resources.
- When water pressure in the pipes is not enough, water leakage could cause water contamination by drawing wastewater into the pipeline. Such problems are likely to occur if the water supply is intermittent, the leakage point is at the end of the network, or if the elevation of the network is high. Water leakage can also cause low water pressure in the pipes downstream. Reducing leakages improves these issues related to water quality and pressure, and improves customer satisfaction.
- Leakage reduction prevents other problems related to leakage, such as a traffic accident at a caved- in road caused by the leakage.

(b) Significance and Benefits of Reducing Commercial Loss

- By reducing illegal connection and metering errors, it becomes possible to increase the amount of billable water, and thus increase the revenue.
- Reducing illegal connections and verifying/renewing malfunctioning meters contribute to building trust with customers.
- Reducing illegal connections could also reduce the leakage from the illegal connection sites.

(c) Significance and Benefits of Reducing Unbilled Authorized Consumption

- Unbilled authorized consumption is usually not a target for reduction, unlike the reduction of physical and commercial losses. However, in theory, revenue can be increased by reducing unbilled authorized water. Moreover, the amount of unbilled authorized water must be monitored correctly in order to carry out water balance analysis (water distribution analysis). Therefore, water meters should be installed even for unbilled authorized water.

A study by SIDA (2000) stressed that Non-revenue water (NRW) often constitutes a major problem in water supply systems, resulting in considerable loss in revenues and necessitating excessive production. The reduction of non-revenue water will contribute towards mitigating the impacts of climate change on water security leading to increased opportunities for achieving the Sustainable Development Goal number (SDG) 6 (Hoko & Chipwaila, 2017). This means that if public utilities like Blantyre Water Board reduce their NRW, they will stand a chance of increasing revenue which can be reinvested into infrastructure upgrading.

2.5 NRW management in Blantyre City

In many developing countries, high rates of non-Revenue water (NRW) remain a serious problem, although the importance of reducing NRW is well known to the water sector (JICA, 2020). This cannot be understated in Malawi as high NRW is also a problem. High NRW rates are said to be caused by all three components of NRW (Gowela et al., 2017a). Blantyre Water Board (BWB) is responsible for water abstraction, treatment, distribution, and the water quality monitoring within Blantyre and some surrounding areas. The utility company is responsible for supplying water to about 1.4 million people within supply area

which includes Blantyre City and other areas such as Bvumbwe, Chileka, Lunzu, Chiradzulu, Limbe and Mapanga (BWB, 2021). Raw water is extracted from Shire river (an outlet to lake Malawi) at Walkers Ferry which is about 40 kilometers away and 800m below Blantyre. Currently, BWB produces a total of 101 million liters of water a day, with the main treatment plant at Walker's Ferry producing 96 million liters per day covering 95 percent of the total water produced and rest being produced at Mudi dam amounting to 5 million liters of water per day. This input amount barely meets the demand for water as the supply area requires 123 million liters of water per day hence creating a deficiency of 22 million liters (Blantyre Water Board, 2017). Currently the company has about 40,000 customers with an average of 300 connections registered every month. This shows that the water supply is under water strain and the supply area is already facing water shortages which are expected to become severe over the coming years, unless major investments in water loss reduction and additional water production is undertaken. In 2017, Blantyre Board embarked on a project to construct a new water supply system from Likhubula river in Mulanje to Blantyre water supply areas, that will add an additional of 20 million liters into the system that will benefit a total of 300,000 people in Limbe, Bangwe, Mzedi, BCA Hill, Chigumula, Namiyango, Nguludi, Triazolo and Malawi University of Science and Technology (BWB, 2017). However, despite all these attempts to increase water supply systems, if NRW is left unchecked, which is reported to be more than 50% (Tembo, 2016), the efforts will be futile. Blantyre Water Board has a slogan "Water is life, conserve it" which means that people should use all measures to protect water through efficient use, caring for it properly through reporting of faults and any malpractices. This study, will therefore, establish whether awareness campaign has an implication on public perception and participation on NRW reduction.

3 CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter describes the research methodology that was used to conduct the study. The section outlines the research design, study area, target population, sample size, sampling techniques, data collection methods, analysis and techniques. The chapter also presents the validity and reliability of the study.

3.2 Research approach

The research approached for this study was a mixed method, both qualitative and quantitative methods. The research approach was both qualitative and quantitative in nature since the study intended to capture themes and views through an in-depth interview and verbally interpret the respondents' views on their participation in Non-Revenue Water management. Again, study was also approached with a quantitative method because it was aimed at determining facts, demonstrating relationships between variables and predicting outcomes. Alliaga & Gunderson (2006), describes quantitative study as a research approach explaining a phenomena by collecting numerical data that are analyzed using statistical approaches. Marshall (1996), further stated that quantitative research as a method that produces reliable quantifiable data can potentially be generallised to a large population. In this case the public participation as a model for managing water resources and components of a distribution system.

3.3 Research design

According to Boru (2018), a research design is a procedure for collecting, analyzing, interpreting and reporting data in a research study. Boru (2018), further indicated that there are three types of research designs which include descriptive, exploratory and explanatory design. This study used descriptive survey research, which was preferred because it was able to collect data that answer questions concerning public participation in non-revenue water management in Namiyango and Chigumula. According to Miruka (2016) and Mugenda & Mugenda (2003), descriptive survey design determines and reports the way things are and also assist the research to describe a phenomenon in terms of values, attitudes and characteristics. Miruka (2016), further pointed out that descriptive survey

research collects data by administering questionnaires and interviewing a sample of people. Therefore, it is in this sense that the study adopted descriptive survey research to understand public participation in non-revenue water management: a case of Namiyango and Chigumula.

3.4 Study Area

The study was conducted in the areas of Namiyango and Chigumula. Both areas are located in Blantyre City. Blantyre is geographically located at 15° 47' S, 35° 0' E in the southern region of Malawi and it is the second largest capital urban center located 311 kilometers southeast of the national capital, Lilongwe (Tembo, 2016). The areas were chosen because of their large differences in NRW rates. Using information given by Blantyre water Board, Namiyango's NRW rate reached as high as 50 percent in the month of May, while Chigumala recorded only 10 percent NRW in the similar month. The areas are also characterized by water leakages in main supply, vandalism of supply pipes and leakages in mostly household connection pipes. Blantyre Water Board has been sensitizing people in the city to report vandalisms, faults, leakages, unauthorized water connection and the essence of conserving water. It is in this regard that it was crucial to conduct the study in the two areas in order to determine public awareness on NRW, actions taken when observed any NRW issue, public concern on NRW and means of reducing the NRW in the area. Again, the area was also selected because of its proximity and accessibility.

Below is the map of Blantyre City showing the study areas of Chigumula and Namiyango.

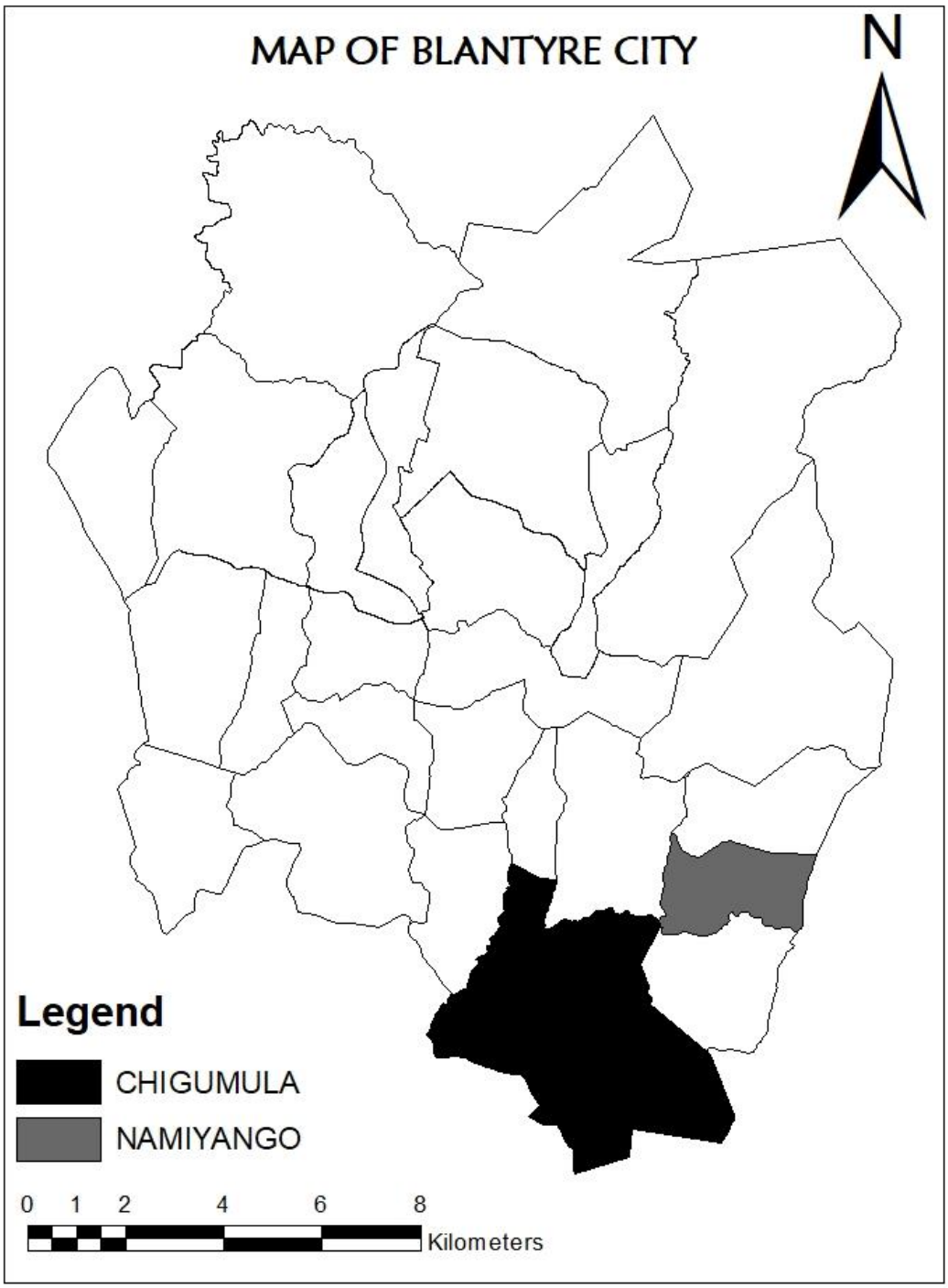


Figure 2 Map of Blantyre City showing Study areas

3.5 Methods and materials

To achieve the objectives of the study namely; to assess public knowledge and awareness of NRW issues and NRW reduction, to identify public concerns and actions towards non-revenue water loss and to assess how the current system for reporting NRW has evolved over the years. The following materials were used in the study; Pens, Blantyre Water Board annual reports and a phone. A questionnaire was used as a data collection tool. To achieve objectives one and two on assessing public knowledge and awareness of NRW issues and NRW reduction as well as to identify public concerns and actions towards Non-Revenue Water loss, a questionnaire was made into sections which included socio-economic characteristics of the respondents, perception on water issues, knowledge on Non-Revenue Water as well as concerns and actions towards water loss. Details given by the respondents were filled down on the questionnaire using a pen by the respondents and sometimes by the investigator depending on the choice of the respondents. A second questionnaire which aimed to gather further deals on amount of water and NRW for the study was also sent to Blantyre Water Board to be responded to by the officials. In order to achieve the last objective which intended to assess how the current system for reporting NRW has evolved over the years, secondary data was used which included reviewing annual reports that are published by Blantyre Water Board on its website (https://www.bwb.mw) at the end of each year. For the interest of this study reports dating from 2000 to 2018 were used to obtain the annual percentage of NRW. Again, informants from the Board provided additional details regarding the NRW percentages for 2019 to 2020 since these were not published yet. A phone was used to take pictures and also to inquire on the progress of filling out of the questionnaire by the officials from Blantyre Water Board.

3.6 Sample selection method

A sample of 86 respondents was used to represent a population of respondents from Namiyango and Chigumula. Both purposive and random sampling was used to select areas of study and households. According to Cooper & Schindler (2014), purposive sampling is described as a way researchers chooses a particular area arbitrarily for their unique characteristics or their experiences, attitudes, or perceptions. In this case Chigumula and

Namiyango were selected due to their proximity to each other and their differences in NRW rates. A simple random sampling was used to select households in the study areas just as the like other similar studies conducted by (Ojo, 2011). In each selected household, a questionnaire was used to gather data from any of the members of the households. However, the exclusion behavior was performed on all household members that were below the age 18 years. The study was performed in households since these are likely to have knowledge of the area as they are the residents of the area of the study.

3.6.1 Sample Size

Sample size for the study in the two areas was set to 86 respondents. The sample size was set in line with reference to other studies conducted by Gowela, 2017 and Gowela et al., 2017, that stated that a service area of more than 30 respondents is suitable for research. Therefore, each was had a target of 43 respondents.

3.7 Data analysis

The data that was collected was processed and analysing using SPSS version 26 and Microsoft excel 2016 as tools by following five stages of analysing data. The stages for analysing data include; initial exploration of data, data preparation, data analysis, representation and display (Gowela, 2017). Qualitative data that involved categorical data was analysed using descriptive analysis which determined the frequencies under each category of data, percentages and chi-square test was also employed in order to assess the level of significance in the two areas.

4 RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the findings of the research. The study's aim was to understand participation in Non-Revenue Water management using Namiyango and Chigumula as a case study. Mainly, the study was directed by three specific objectives. The first objective was to assess public knowledge and awareness of NRW issues and NRW reduction. The second objective was to identify public concerns and actions towards non-revenue water loss. Lastly, the final objective was to establish the role when the hotline was introduced and its impact on NRW.

4.1.1 Response rate

The study achieved a response rate of 87.2 percent, due to time constraints and lack of funding. However, Mugenda & Mugenda (2003), proposed that a response rate of 50 percent is adequate for analysis and reporting. Mugenda & Mugenda further satated that response rate of 60 percent is good and a rate of 70 percent and over is excellent. Therefore, the rate of response for this study was excellent.

Table 1 Sample distribution

Name of Area	Targeted number of Household per area	Questionnaires Distribution per area	Questionnaires completed per area
Namiyango	43	43	37
Chigumula	43	43	38
Total	86	86	75

4.2 Socio-economic characteristic of the area

At least 53.3 percent of the respondents sampled were females and 46.7 percent were men. Regarding the ages of the participants, in Chigumula 68 percent participants were from the ages of 21 to 50 which are considered to be the working group and vital for the development of the society (Ojo, 2011). In contrast to Chigumula, Namiyango had most

of its respondents who were either above 50 or from 18 to 21. The ages above 50 comprises of people who are either retired or about to retire and those from 18 to 20 are either schooling or not yet employed

Table 2 Socio-economic characteristics of the respondents

Item	Chigumula		Namiyango	
	Frequency	Percentage	Frequency	Percentage
Gender				
Male	18	47.37%	17	45.95%
Female	20	52.63%	20	54.05%
Age (Years)				
18-20	2	5.26%	8	21.62%
21-30	2	5.26%	10	27.03%
31-40	17	44.74%	6	16.22%
41-50	7	18.42%	2	5.40%
Above 50	10	26.32%	11	29.73%
Level of Education				
Primary Education	1	2.63%	10	27.03%
Secondary Education	2	5.26%	15	40.54%
Tertiary Education	24	63.16%	9	24.32%
Other	11	28.95%	3	8.10%
Income per month				
Less than K50,999	0	0%	10	27.02
K51,000-K150,999	1	2.63	6	16.22%
K151,999-K350,999	7	18.42%	7	18.92%
K151,999-K650,000	16	42.10%	0	0%
Above K650,000	11	28.95%	0	0%
No income	3	7.89%	14	37.84%
Access to Water from BWB				
Water tap on premise	38	100%	20	54.05%

Communal water kiosk	0	0%	17	45.95%
Monthly water bill				
Below K7,000	0	0%	23	62.16%
K7,000-K15,999	0	0%	5	13.51%
K16,000-K25,999	1	2.63%	5	13.51%
K26,000-K40,999	7	18.42%	4	10.82%
K41,000-K60,999	7	18.42%	0	0%
K61,000-K80,000	13	34.21%	0	0%
Above K80,000	10	26.32%	0	0%

The differences in levels of education and the number of people within the working age clearly influences the ability to pay for water services. The differences can be clearly seen between the two areas and the levels of the NRW may be attributed to the socio-economic status of the people of the areas.

4.3 Public perception on water issues

In order to assess the public perception of water issues taking place in the two areas of the study, respondents were asked open ended question on the major water issues experienced in their areas. Intermittent water supply and burst pipes were popular in both areas of the study. Other issues such as exorbitant water prices, few communal water kiosks, vandalism of water infrastructures, water pollution were some of the issues which were area dependent as per study were also stated. As shown in the table below, the variations existed in the water issues experienced depending on area.

Table 3 Major water issues

MAJOR WATER PROBLEM	AREA	
	CHIGUMULA (N = 38)	NAMIYANGO (n = 37)
Intermittent water	60.50%	37.80%

Vandalism of water infrastructures	0%	10.80%
Water pollution	0%	24.30%
Burst pipes	10.5	16.20%
Few water collecting points	0%	8.10%
Exorbitant water prices	15.70%	0%
Not sure	13.30%	2.70%
TOTAL	100%	100%

The responses given by respondents indicated intermittent water as one of the major problems in the areas with Chigumula recording the highest percentages of 60.5 while Namiyango recorded 37.8 percent of the respondents. Other issues such as few water collecting points and vandalism were also stated in Namiyango. According a 2015 Review margazine article by BWB (2015), the board loses money amounting to K480 million kwacha in a year and K40 million every month due to vandalism of Water Board infrastructures such as pipes and other components in the distribution system. The board went on further to point out that as a way of prevention efforts, vandalsim policy has been established. The policy focuses on the prevention of vandalism, strengthening partnership and resource mobilization which will foster a sense of responsibility and ownership of water infrastructure by BWB. The board also reviewed that concrete asbestos pipes for the Board are vandalised just to get free water out of them. The issue of burst pipes recorded 10.5 percent in Chigumula and only 16.20 in Namiyango. This is reveals most people in both areas do not regard burst pipes and other contributers of NRW as major problem. In a similar study by Frauendorfer & Liemberger (2010) on the issues and challenges of reducing NRW, pointed out that NRW impairs the ability of water utilities to satisfy customer's demand due to loses of large volumes of water as a result intermittent water supply follows.



a b

Figure 3 a and b: showing small distribution pipes leaking in Namiyango

During the study, It was observed that cases of pipe leakages and sporadic water supply are very common in Namiyango. Despite that taps had no running water during the time data was collected in Namiyango as shown above in the pictures, it is evident enough that water is lost through pipe burst and leakages hence contributing to the increasing percent in NRW in the area.

4.4 Public knowledge on NRW

Section three of the questionnaire on knowledgeon NRW prompted respondents to chack their awareness and the point out what they felt as the impacts of NRW. Most respondents from both areas gave a postive answer. Chigumula had 81.6 percent of respondents and Namiyngo had 62.2 percent of the respondents who responded yes. The chi-square analysis ($x^2 = 7.664$, $df = 2$, $p = 0.022$) indicates that Knowledge on NRW/Water loss is significantly different between people of Chiguma and Namiyango. That is, the majority of the respondents from Chigumula know what NRW is than respondents from Namiyango as shown in figure below.

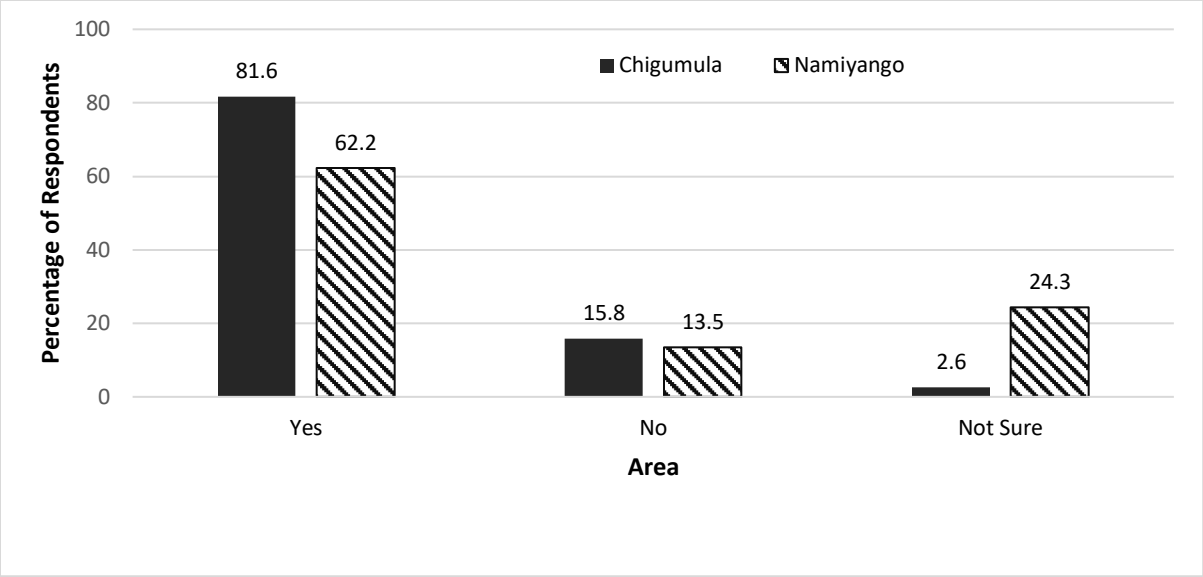


Figure 4 Public knowledge on NRW

The study has established that the majority of the respondents from Chigumula and Namiyango have the knowledge of NRW. Despite the greater majority, significantly a good number of respondents were not sure and had no knowledge of NRW. This could be attributed to the attainment of at least secondary level of education the respondents. Lack of public knowledge on NRW among respondents especially in Namiyango could be attributed to the fact that they do not understand the term NRW as it is a technical word mostly used in the water sector. Public knowledge on NRW in Namiyango was expected to be high due to high prevalences of water pipe bursts and leakages. However, the knowledge on NRW is almost average. This shows that significantly a good number of people are not aware of NRW which makes it difficult for them to participate in NRW management or take appropriate action. Poor knowledge on the term NRW also affected public participation in NRW reduction in Malaysia as reported by Lai etal. (2017). Unlike Namiyango, Chigumula experiences low NRW. This could be as a result of the high pulic knowledge on NRW (as shown in figure 4) by the majority of the population who get concerned and take drastic action when they spot pipe bursts, leakages and illegal water disconnection.

4.5 Responsibility in NRW reduction

4.5.1 Public Responsibility

To assess if the public felt that they have a responsibility in NRW/water loss reduction, section four of the questionnaire was presented to respondents. To this section most respondents, 86.8 percent, from Chigumula responded positively. While Namiyango had slightly lower percentage of 78.4 percent. The chi-square analysis ($x^2 = 1.058$, df = 2, p = 0.590) shows no significants difference regarding public responsibility in NRW reduction despite them coming from different areas. The majority of the people from Chigumula were of the view that the public has a greater responsibility to take initiative in NRW management than those from Namiyango. However, 10 percent of respondents from Namiyango were of the view that public does not have responsibility in water loss or NRW reduction as compared to 5.3 percent of respondents from Chigumula.

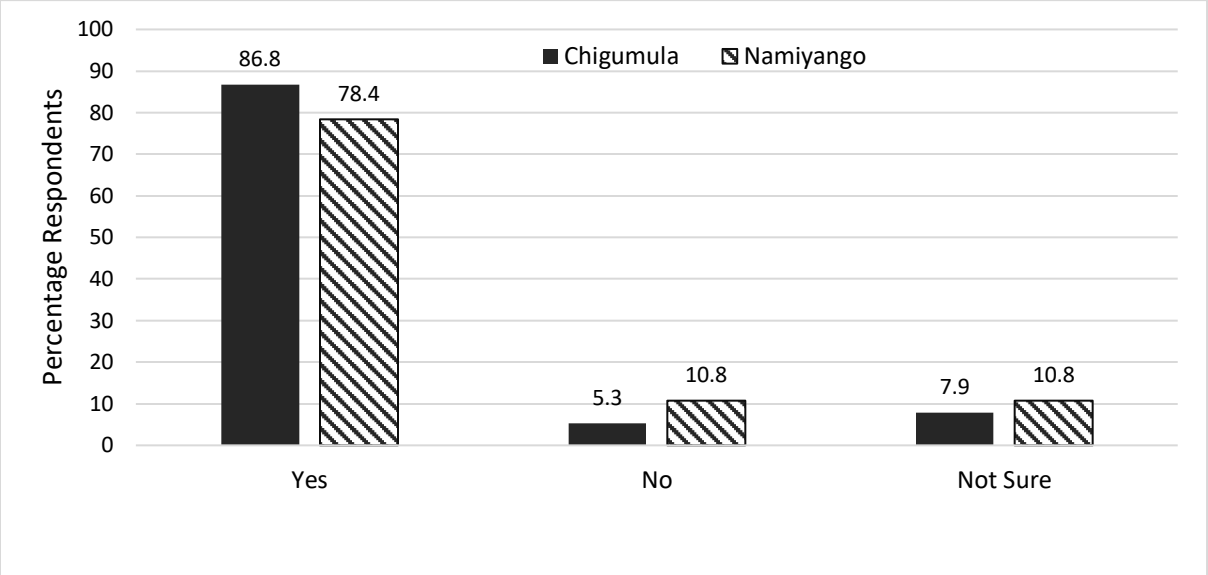


Figure 5 Public responsibility in NRW reduction

The study has revealed that the public feels they should be more responsible for reducing NRW in their areas. The desire to feel more responsible for NRW reduction in Chigumula could be the reason why there were lower amount of NRW from the months of March to May, 2021. This suggest that people in Chigumula feel more responsible to report any water malpractices or report any pipe burst to BWB as they know that any failure will lead to water interruption. Though not significantly different to Chigumula, failure to accept to

be responnsible for water loss management or take action by people in Namiyango could be the reason why the area experiences high NRW losses. It may also be possible that most respondents in Namiyango have never experienced a serious water supply issue caused by high NRW, or they did not know high NRW rates could cause water supply interruptions.

4.5.2 Self-responsibility

Inorder to understand the perception each respondent had on self responsibility, section 5 of the questionnaire was presentend to them and most of the respondents of Chigumula maintained their resolve that if the public have a responsilibility therefore, an individual also have the responsibility to solve BWB water loss issue. 81.6 percent of responds from Chigumula indicated that individuals have resposibility in solving BWB water loss issue. Again, Namiyango also registered a high percentage of respondents with 78.4 percent giving a postive answer that individuals too have a responsibility (Figure 6). Chi-square test ($x^2 = 3.450$, df = 2, p = 0.178) shows no significance differencies in terms of the individual responsibility for the reduction of the NRW in their areas. Though not significants, most respondents from Chigumula were of the view that individuals should be responsible for solving the water loss isue in cases of pipe bursts, leakages or illegal water usage and any other water related issue, than those from from Namiyango shown in Figure 6 below.

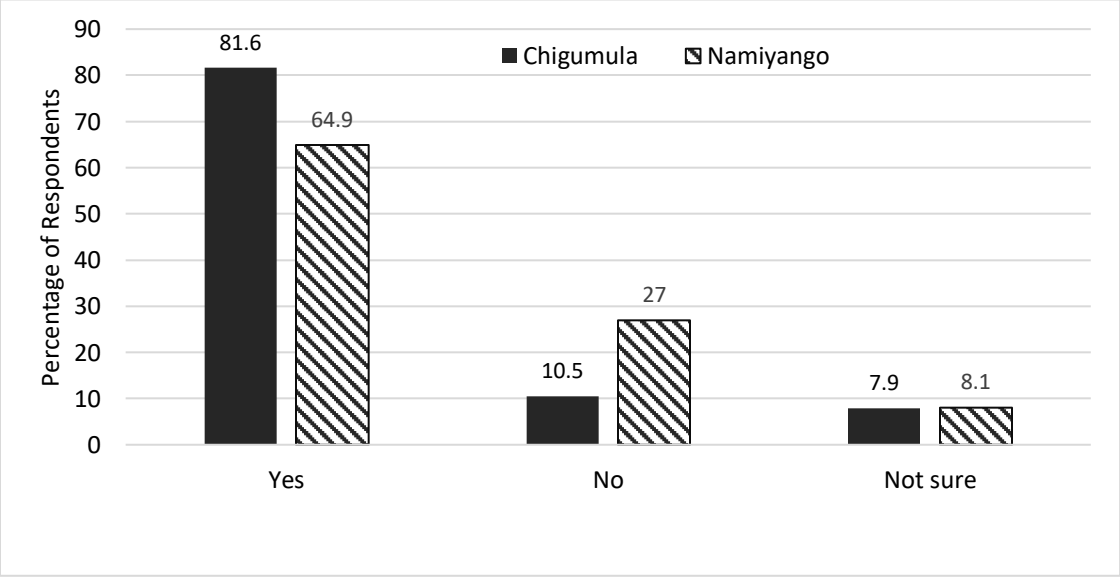


Figure 6 Individual/Self responsibility in NRW

Following the question on self responsibility, all respondents that gave a postive answer were asked to state the kind of responsibily they felt that they had, most of them responded that their responsibility is to report to right authorities in this case BWB, abiding to the by-laws and also went on ahead responding that, individuals have responsibility in repairing damaged pipes to prevent more water from being lost. However, according to Water Works Act of 1995, which clearly states in part III on further powers to the Board, that all supply pipes are property of Board, in this case BWB retain any right to carry out all the maintenance and water works as deemed necessary. The act further stated that such activities are to be conducted people authorized by the board in writing. The act further stated in part VII on offences that any person who willfully and negligently causes damage to any waterworks, public fountains , public sewers, services, or meters, shall be guilty of offence and shall for every offence be liable to a fine (Water Works Act, 1995). Following the act, the only responsibility individuals and the public have is abiding to the bylaws, reporrting cases of illigal water connection and burst pipes. However, for people to abide to bylaws, report cases of illegal water connection or pipe bursts/leakages, they need to be involved in NRW management by water utilities. Public involvement has been overlooked by many water utilities (Frauendorfer & Liemberger, 2010; González-Gómez et al., 2011) leading to continued water loss. González-Gómez et al. (2011), stressed that the reasons why NRW rates cannot be effectively reduced in some cities is due to a lack of public participation in NRW reduction activities. Therefore, including the public into NRW management programs and give them incentives could motivate the public and individuals to be more responsible for water loss reduction as suggested by Lai, et al (2017).

4.6 Views on those held responsible for NRW/Water loss reduction

Respondents were asked to give their views on who should have high responsibility of reducing NRW/water loss. As indicated in the table 5 below, most respondents from Chigumula totalling 47.4 percent stated that the public have a high responsibility or reducing non-revenue water loss which was secondend by 36.8 percent for BWB. On the other hand, 40.5 percent of Namiyango stated that BWB have a high responsibility for water loss reduction. The two areas exbited different views on who thy felt had a high responsibility of NRWL reduction.

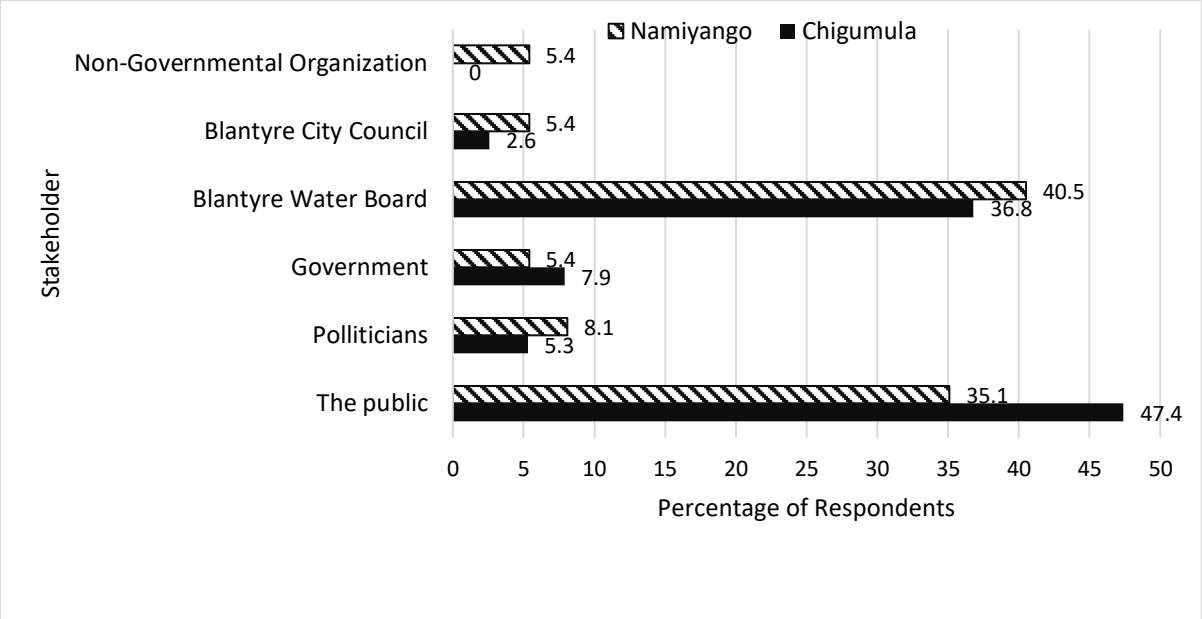


Figure 7 Views on those held responsiblr for NRW/Water loss reduction

Respondents views on who should have the responsibility in NRW Reduction showed that a significant number of respondents from Namiyango and Chigumula have high expectations of the BWB and the public (themselves) to play a bigger role in solving water loss issues. For instance, the majority of the respondents in Chigumula thought that they should be responsible in solving water loss unlike in Namiyango where the majority indicated that BWB should be responsible for water loss reduction. High expectation by the public in Namiyango that BWB holds high responsibility in water loss management could be because the public has limited capacity to solve water loss issues. Similar finding was also reported by Lai et al., (2017) in Penang and Perlis State in Malaysia. High frequency of burst pipes could be costly for the public to renovate hence shift the responsibility to BWB who are already registering High NRW in Namiyango as compared to Chigumula as shown in table 6 below. Low NRW in Chigumula suggests that the public have somewhat the capacity to solve water loss issues as the levels of NRW are small. Table below provides the latest data on the amount of water per area that is received and lost through NRW in the year 2021.

Table 4: Comparison of NRW between Chigumula and Namiyango

		Chigumula	Namiyango
Amount of water received per month		10,500m^3	30,000m^3
NRW	March	1,029m^3	9,150m^3
	April	577.5m^3	9,000m^3
	May	1,050m^3	15,000

4.7 Concern and actions towards water loss (Non-Revenue Water)

4.7.1 Public concerns

In response to section 8 and 9 of the questionnaireorder which dealt with issues of meter inaccurancy, pupe burst and reporting to BWB. The respondents gave a range of answer that vaied across the areas. The study established that water loss concern through pipe leaking or burst at the roadside is very serious problem at Chigumula (55.3%) unlike at Namiyango (29.7%). Public concerns regarding water loss through pipe leaking or burst at roadside were not significantly different as p-value was greater than 0.05. This suggest that there is commonality in terms of people's concern with water loss as a result on pipe burst and leaking in Namiyango and Chigumula. On puplic concern regarding water loss through meter inaccuracy respondents' homes, the majority respondents (68.4%) from Namiyango indicated that it is a very serious problem unlike Chigumula which recorded as low as 43.3%. Concerns of people of Namiyango and Chigumula regarding water loss through meter inaccuracy were also not significally different (p-value=0.09). On the hand, public concerns on water loss through Illegal pipe connection also showed no significants even though serious concerns were registered at Chigumula, 68.4% than Namiyango, 43.3%. Public concerns on NRW or water loss have been presented in table below.

Table 5 Public concern on water loss/NRW

Is below Incidents a Serious Problem for You?	Area	Not a problem	Not too serious problem	Somewhat Serious Problem	A very serious problem	Chi–square value	df	p-value
Water loss through pipe leaking or burst at the road	Namiyango	16.2%	10.8%	43.2%	29.8%	5.351	3	.148
	Chigumula	7.9%	5.3%	31.6%	55.2%			
Water loss through meter inaccuracy at your home interms of underchargin g	Namiyango	35.1%	10.9%	35.1%	18.9%	11.599	3	.009
	Chigumula	13.2%	0%	44.7%	42.1%			
Water loss through Illegal pipe connection	Namiyango	18.9%	8.1%	29.7%	43.3%	9.569	3	.023
	Chigumula	0%	7.9%	23.7%	68.4%			

According to Lai etal. (2017), the degree to which a person is concerned about NRW-related issues could determine the action that will be taken by a person, if the issue is noticed by the person. This is very interesting as the results presented in table 3 show that the respondents in both areas were concerned about pipe leakage, meter inaccuracy and illegal water use. However, is is also established that some of the respondents were not concerned of water loss through Illegal pipe connection, water loss through meter inaccuracy at your home and water loss through pipe leaking or burst at the road.

Respondents deemed them not a problem and not a serious problem. This suggest that there is lack of awareness on water issues in the areas. People do not know the effect of water loss as they may have either not experienced heavy water interuption due to greater volume of water loss or because the long term effect of pipe leakages and burst take time to experienced. Depite no significant differences on respondent's concerns on water loss/NRW from both areas, a lot of people from Chigumula deemed water loss through pipe leaking or burst at the road as a very serious problem unlike Namiyango. This might be the reason why there are less cases of pipe burst in Chigumula as people always feel responsible to take an action to reduce the water loss. Similar to water loss through pipe leaking or bursts, illegal water cnnection was also am major concern at Chigumula as the majority believe the malpractice could lead to water interuption in the area. This was not the case at Namiyango as people concern were below average. This might be due to people never heard of illegal water connection or no knowledge on how illegal water connection could lead to water problems in their area.

4.7.2 Actions towards NRW loss

Firstly, respondents were asked several questions if they had ever seen a burst pipe by the roadside, the frequency of such cases and the action they take when they encounter such. On whether respondents have ever spotted pipe leakage or pipe burst by the roadside, the majority of the respondents gave a positive answer. For instance, most respondents (86.8%) at Chigumula and 94.6% at Namiyango indicated that they spotted pipe leakage or pipe burst by the roadside. Smaller proportions 13.2% and 5.6% indicated that they did not spot pipe leakages or burst at road side at Chigumula and Namiyango respectively (figure below). Chi-suare analysis shows no significant differences on peoples responces (x^2 =1.331 ,df = 1, p = 0.249) despite coming from different water supply areas.

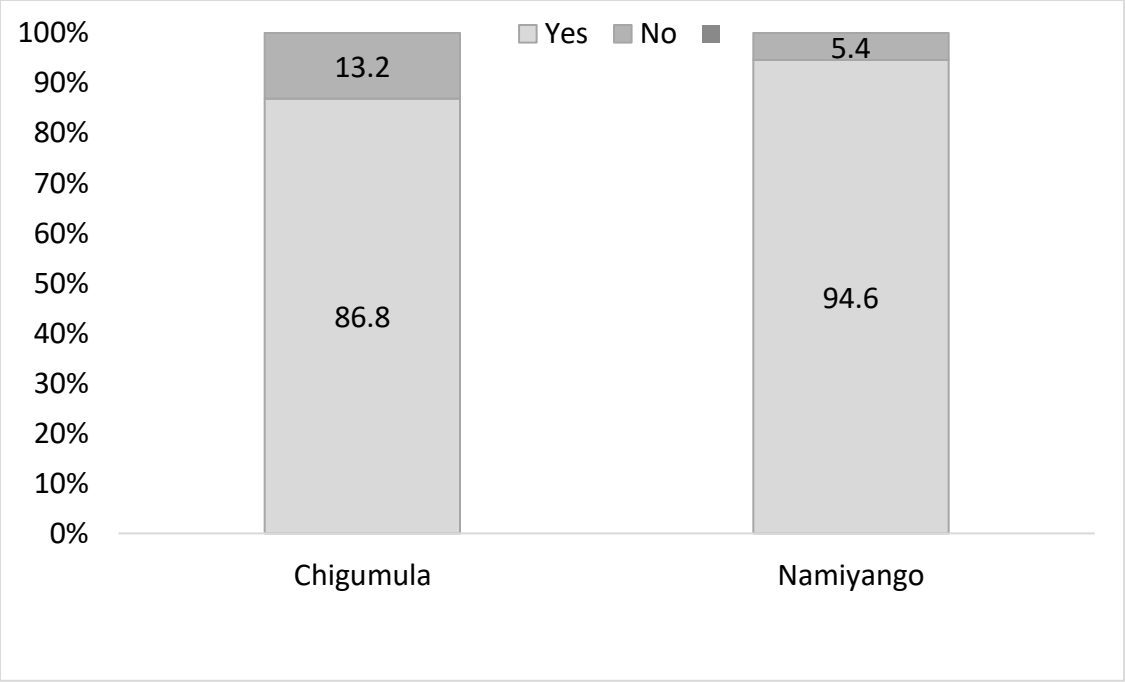


Figure 8 Knowledge on pipe leakages or pipe burst by the roadside

On the likelihood of respondents to report to Blantyre Water Board, when they see a pipe burst or leaking, the majority of respondents (60.5%) from Chigumula indicated that they will likely report to BWB while very few were not sure, very likey, very unlikey and unlikely as shown in the table below. On the other hand, the majority of respondents at Namiyango indicated that they will likely (29.7%) and unlikely report to BWB. Very few respondents from both areas indicated very unlikely and very likely.

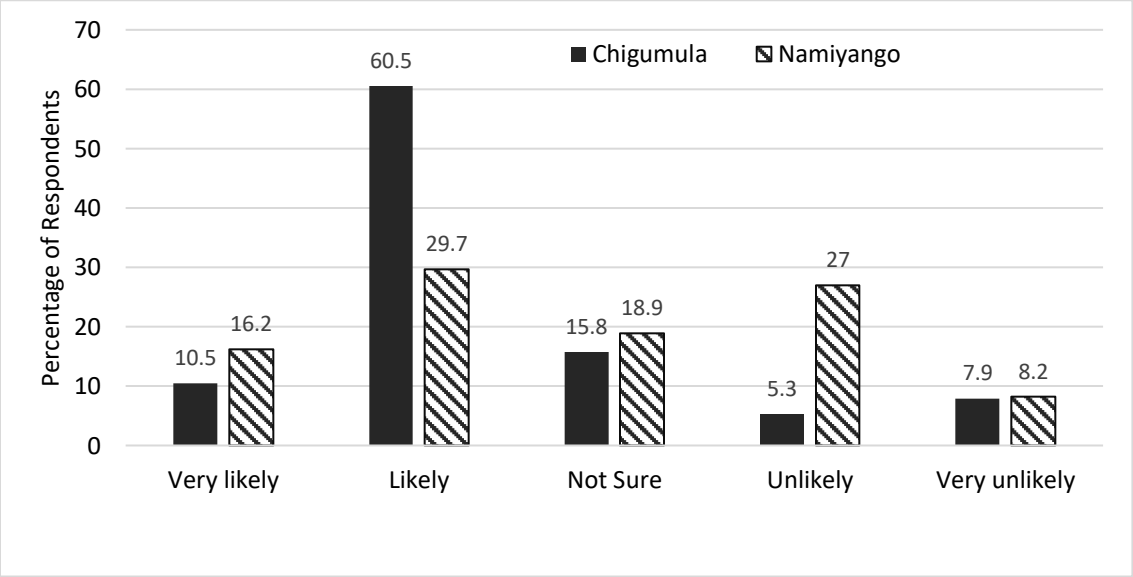


Figure 9 Likelihood of reporting leakage or pipe burst by the roadside

In order to establish as to whether respondents ever reported to BWB about water loss issues, a set of parrameters was designed. Most respondents from both Chigumula and Namiyango did not report any cases of water loss despite water loss being most prevalent in their areas as shown in figures below.

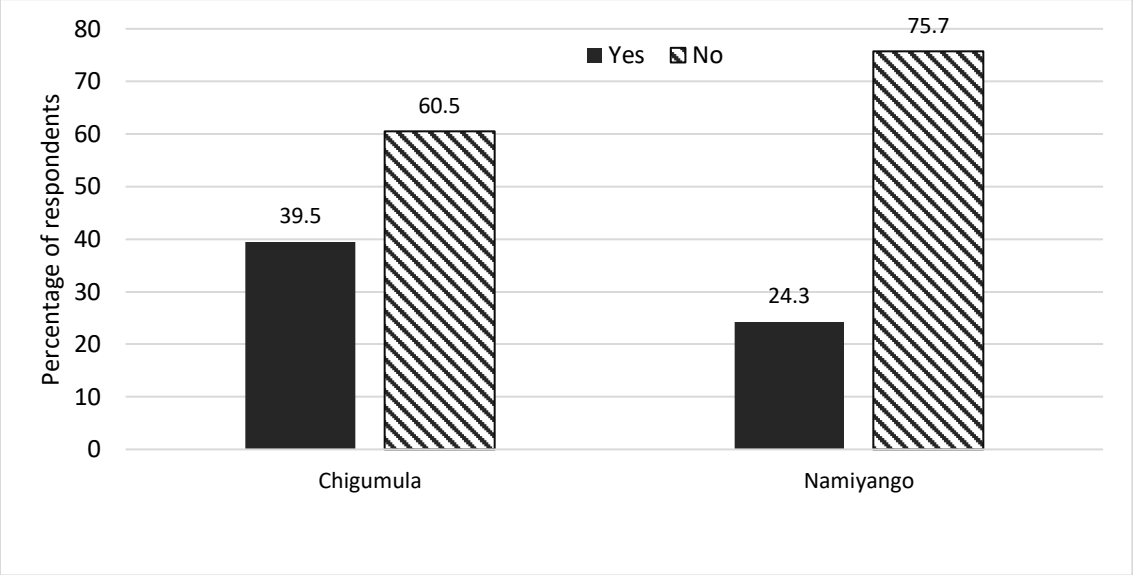


Figure 10 Reported to BWB when they had seen a burst or leaking pipe

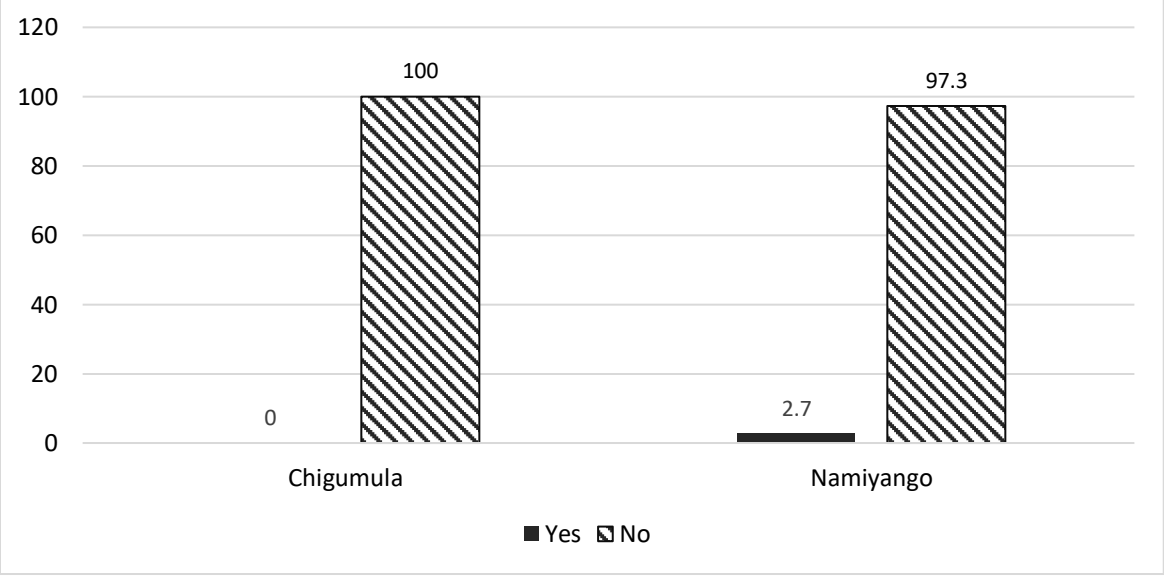


Figure 11 Reported to BWB about illegal water connection malpractices

It is evident from the results presented above that the majority of the respondents in both areas never reported to the BWB when they encountered a pipe burst or leaking pipe. Though not significance, more respondents from Namiyango did not report to BWB when they had seen pipe burst and were less likely to report pipe leakage or pipe burst by the roadside or pipe leakage as compared to those of Chigumula. Lai et al. (2017) attributed failure by public to report any observed leakages to water service providers to the process for making such a report. This might be true as most respondents at Chigumula indicated to have BWB contact number, but never reported any illegal water connection malpractices. No report on illegal malpractice at Chigumula was attributed to no case of illegal water connection observed by respondents. However, respondents from Chigumula did not report pipe bursts or pipe leakage due time taken to answer the call. For instance, one of the respondents stated that, "normally when we try to alert them of the problem the phone call may take long time to be answered or mostly it says it's on another network. This discourages us to attempt several times". Other respondents indicated that "we do not have the BWB contact and there is nothing we can do as we are not given the numbers". An availability of the BWB contact by most people of Chigumula can be the main reason why the area registers low NRW as people, though smaller proportion, are able to report NRW issues in time. However, this is not exactly the case in Namiyango as most people in the area do not have BWB contact. This makes it difficult for them to report water loss issues in time as they may be forced to waste time searching for those people who have it. No report on illegal water connection and water leakages in Namiyango could be attributed to the majority not having BWB contact. This might also be the reason why most respondents were not sure and unlikely to report water loss issues to BWB.

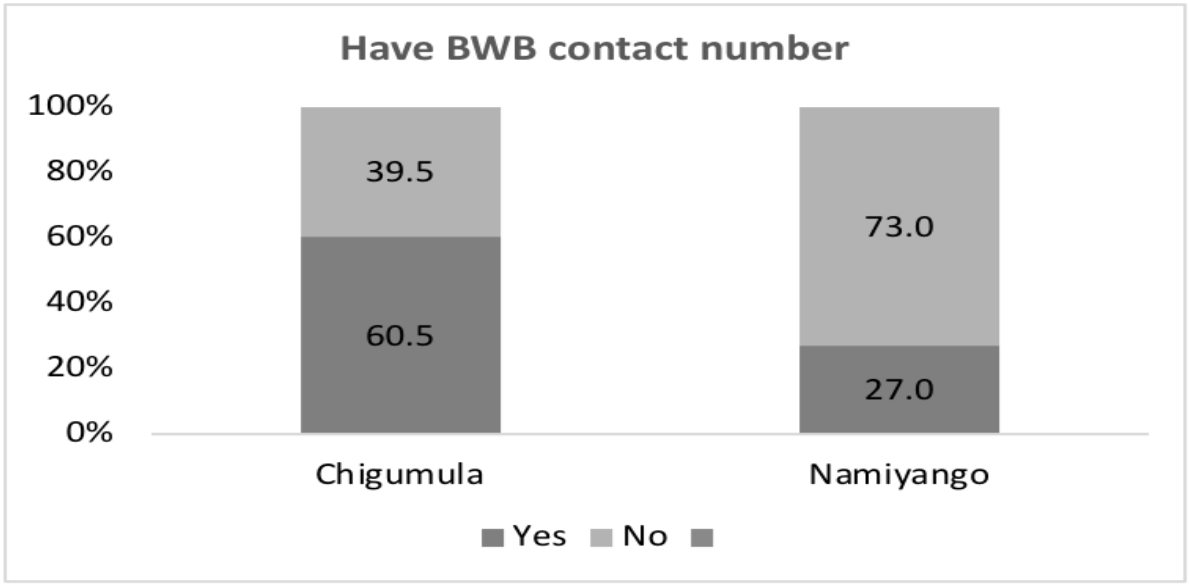


Figure 12 Percentage of people with contact number for BWB

4.8 Trend for NRW for the past 20 Years

Key informants from BWB provided provided information regarding NRW percentages for the year 2019 and 2020. The informants revealed that NRW at BWB in the years 2019 and 2020 wee 37 and 54 percent. Other information regarding the NRW were obtained by reviewing annual reports that are published annually by the Boad on its website. Data regarding the findings is presented below (Figure 13)

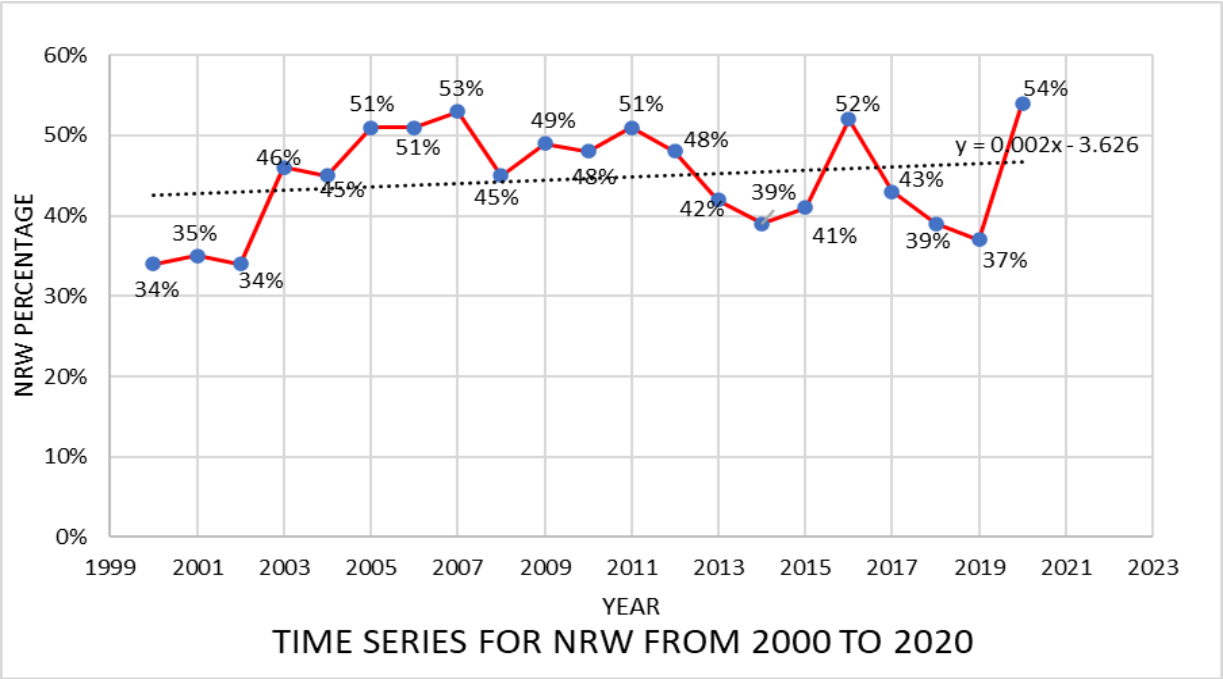


Figure 13 Time series plot for NRW percentages from 2000 to 2020

As shown in the figure above the NRW rate is rising at a constant rate. Initially the levels of NRW were almost costant in the years 2000 to 2002 and drastiically increased from 2003 through 2021 at a costant rate. Despite the BWB introduced the hotline number for the pubilic to report water loss issues in 2015, NRW continued to go upward from 2015 to 2016. This could be due to low public awareness campaigns to sensitize the public on the importance of reporting faults in time to service provider. From 2016 to 2019 NRW started to go down. This could be due to instalation of new pipes by the BWB, introduction of new meters and also public being concerned about water loss issue and report them to BWB. However, from 2019 to 2021 there has been an increase in NRW dispite new pipes being installed and new water meters being installed to the majority of customers for accurate reading. This may mean that the public have not been fully incoporated into the NRW management. According to González-Gómez et al. (2011), the reasons why NRW rates cannot be effectively reduced in some cities is due to a lack of public participation in NRW reduction activities. Through public participation in NRW management activities, Cambodia water service managed to reduce NRW rate from 68% in 1993 to only 6.19%

in 2018 (Biswas & Tortajada, 2009). This indicates that if the current ways of handling NRW are not revised by BWB, NRW will continue to increase.

5 CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

This study was mainly carried out to understand public's participation in NRW management in Chigumula and Namiyango with the aim of determining ways to improve public participation in NRW reduction. The findings have shown that the majority of respondents do not participate in NRW management in the study areas with more non-participants recorded in Namiyango than Chigumula. The finndings also show that the majority of the respondents have knowledge in water loss in the areas, unlike the term NRW, due to the word being technically used in water industry and lower levels of education. The findings also show that despite the public and/or individuals feel they should be responsible for NRW reduction, still the majority expect BWB to play a bigger role or be responsible for reducing NRW rates. Despite the majority of respondents from both areas fell concerned of water loss issues, they do not report to BWB when they find leaking or bursting pipes on the road or encouner illegal water connections. The findings also shown that the majority of people do not save the BWB's phone number into their mobile phones or in their diaries for imminent reporting in case of water loss issue encounter. The findings have also shown that despite the established hotline for water loss issue reporting, NRW have not really reduced but increase exponentially. Therefore, based on these research findings, public involvement in NRW management in Blantyre still has plenty of room for improvement.

5.2 Recommendation

Based on the findings of this study, it is recommended that this study be done in a broader area so that it can capture views of the many from the public. Again, there is a need to research on the reseasons why the BWB service hotline has not been helpful enough to lead to NRW reduction. More research on factors that hinder public particiation need to be carried out.

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Appendices
Questionnaires

PUBLIC PARTICIPATION IN NON-REVENUE WATER MANAGEMENT: A CASE OF NAMIYANGO AND CHIGUMULA

Questionnaire

My name is Steven Gowela, a Bachelor of Science (BSc) student in Water quality management at Malawi University of Science and Technology. I am doing a research on Public participation in Non-Revenue Water Management in Namiyango and Chigumula, Blantyre. Please feel free to answer the questions that are listed in this questionnaire. All responses will be treated with caution and that confidentiality will be a must.

Instructions

- Please circle on the appropriate choice and provide a description where ever necessary
- Please do not write your name on any page of the questionnaire

Section 1- Socio-economic characteristics of respondents

1. Please select your gender

□Male □Female

2. Which age group do you belong to?

□18-20 □21-30 □31-40 □41-50 □Above 50

3. What is your level of education?

□Primary education □Secondary education □Tertiary Education

□Other, specify……

4. How much do you get per month as your month income? Please select the ranges below.

□Less than K50,000 □K51,000-K150,000 □K151,000-K350,000

□K351,000-K650,000 □Above K650,000 □No income

5. How do you access portable water from Blantyre water Board?

□Water tap on premise □Communal water kiosks □Other, (specify) ……

6. What is your monthly average water bill?

□Below K7,000 □ K7,000-K15,000 □K15,000-K25,000

□ K26,000-K40,000 □K41,000- K60,000 □ K61,000-K80,000

□ Above K80,000

Section 2- Public perception on water issues

1. What is the major water issue in this area?

   .....

2. What is the appropriate solution to this issue mentioned in question 1 above?

   .....

   .....

Section 3- Knowledge on Non-Revenue Water

1. Do you know what Non-Revenue water/ Water loss is?

□Yes □No □Not sure

2. What do you think is the impact of Non-revenue water loss to Blantyre Water Board?

   .....

   .....

   .....

3. What could be the impact of non-revenue water to you as a customer?

   .....

   .....

   .....

4. What is the most appropriate solution for solving Blantyre Water Board water loss issue?

   .....

   .....

Section 4: Public responsibility in NRW/water loss reduction

1. a. Does the public have responsibility in water loss/NRW reduction?

   □Yes □No □Not sure

b. If yes what sort of responsibility does the public have?

……

……

Section 5: Self responsibility in NRW/water loss reduction

1. Should you as an individual be responsible for solving the water loss issue in cases of pipe bursts, leakages or illegal water usage and any other water related issue stated in section 2?

   □Yes □No □Not sure

2. If yes what sort of responsibility, should as an individual have?

   ……

   ……

Section 6: Views on the ones held responsible for non-revenue water reduction/water loss

1. In your own views, who should have high responsibility of reducing water loss/NRW among the following?

   □The public □Politicians □Government □Blantyre Water Board

   □Blantyre City Council □Non-governmental organizations

Section 7: Public concern and actions towards Water loss (Non-Revenue Water) reduction

1. Is water loss through pipe leaking or burst at the roadside a problem to you?

   □Not a problem □not too serious problem

   □Somewhat serious problem □Serious problem

2. Is water loss through illegal pipe connection a serious problem to you?

   □Not a problem □Not too serious problem

   □Somewhat serious problem □Serious problem

Section 8: Personal concerns towards non-revenue water loss

1. Is meter inaccuracy at your home in terms of undercharging a problem to you?

   □Not a problem □not too serious problem

   □Somewhat serious problem □Serious problem

Section 9: Actions towards NRW loss

1. Have you ever spotted pipe leakage or pipe burst by the roadside?

   □Yes □No

2. How often have you seen a pipe leaking or pipe burst by the road side?

   □Very often □Often □Sometimes □Seldom

3. How likely are you to report to Blantyre Water Board When you see a pipe leaking or a pipe burst?

   □Very likely □Likely □Not sure □Unlikely □Very unlikely

4. Have you ever reported to Blantyre Water Board when you had seen pipe burst or pipe leakage?

   □Yes □No

5. Have you ever reported to Blantyre waterboard about illegal water connection malpractices in your area?

   □Yes □No

6. Do you have a contact (phone number) of Blantyre Water Board saved in your phone or written somewhere?

   □Yes □No

Section 10: Public Perception of NRW and the water utilities

Please rate the following on the scale of 1 to 5 where 1 represent strong disagreement and 5 represent strong agreement

1. Burst pipes and corruption increases non-revenue water loss?

   1□ 2□ 3□ 4□ 5□

2. Non-revenue water loss increases cases of water shortage to customers in the distribution system?

   1□ 2□ 3□ 4□ 5□

3. Non-revenue water loss does not affect customers?

   1□ 2□ 3□ 4□ 5□

4. Response time to cases of pipe leakage, breakage and illegal water connection directly affects NRW?

   1□ 2□ 3□ 4□ 5□

5. Reduction in non-revenue water will increase in number of people accessing the water service from BWB?

   1□ 2□ 3□ 4□ 5□

6. Non-revenue water loss reduction can improve the quantity and quality of water supply?

   1□ 2□ 3□ 4□ 5□

7. Non-revenue water loss reduction can help to increase the current water supply service hours by BWB?

   1□ 2□ 3□ 4□ 5□

8. Meter bypassing contributes to an increase in non-revenue water loss?

   1□ 2□ 3□ 4□ 5□

PUBLIC PARTICIPATION IN NON-REVENUE WATER MANAGEMENT: A CASE OF NAMIYANGO AND CHIGUMULA (BWB QUESTIONNAIRE)

My name is Steven Gowela, a Bachelor of Science (BSc) student in Water quality management at Malawi University of Science and Technology. I am doing a research on Public participation in Non-Revenue Water Management in Namiyango and Chigumula, Blantyre. Please feel free to answer the questions that are listed in this questionnaire. All responses will be treated with caution and that confidentiality will be a must.

Instructions

- Please tick/circle on the appropriate choice
- Please do not write your name on any page of the questionnaire

Section A

1. What is the amount of water that is received in this DMA (sector)?

   ……..

2. On average how much water is lost?

   ……..

3. What is the current level of service your company?
4. ……..

5. *How do you rate the level of non-revenue water in your company?*

   1. Very High 2. High 3. Moderate 4. Low 5. Very low

6. What is the level of contribution of bursts and leakages to the overall level of non-revenue water in your organization?

   1. Very High 2. High 3. Moderate 4. Low 5. Very low

a. What do you consider to be the major contributors of NRW from bursts and leakages in your water company?

   (1=Very high, 2=High, 3= Moderate, 4=Low and 5=Very low)

   Please tick in the following table using the above key

NRW CONTRIBUTOR	1	2	3	4	5
Aging infrastructure					
Pipeline pressure					
Quality of water pipes and fittings					
Illegal connections (unmetered water)					
Faulty meters					
Others					

7. What measures are taken by your company are taken by your company to address the contributors of Non-revenue water loss?

   a. Aging infrastructure

   ……

   ……

   ……

   b. Pipeline pressure

……

……

……

c. Quality of water pipes and fittings

……

……

……

d. Illegal water connections

……

……

……

e. Faulty meters

……

……

……

f. Other

……

……

……

8. Please give weight to each measure depending on the DMA (sector/zone)

(1. Very high 2. High 3. Moderate 4. Low 5. Very low)

	1	2	3	4	5
1. A burst pipe/leak detection and repairs program are implemented					
2. Pressure management is used to reduce water losses					
3. A network maintenance/rehabilitation program is implemented					

4. Public awareness and regular community sensitization campaigns on NRW					
5. Other					

Section B: General overview questions

1. *What appear to you to be the performance target priority of your water company?*

   .....

   .....

   .....

2. *According to you, where should NRW reduction be ranked in the priorities of your water company?*

   .....

   .....

   .....

3 a. Does the public have a role in non-revenue water reduction?

   .....

   .....

   .....

b. If yes, how can the public participate in non-revenue water loss management?

   .....

   .....

   .....

   .....

3. Would you recommend a significant investment (say about MWK500 million) in public awareness and community sensitization on participation in NRW management?

.....

.....

.....

4. Among the strategies used in controlling NRW, is there any strategy that does not seem relevant to you or a strategy in which you would not be willing to invest? And why?

.....

.....

.....