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ASSESSING THE CHALLENGES OF DOMESTIC PIPE-BORNE WATER SUPPLY AND DISTRIBUTION IN MILE-GOMA, SABON-GARI LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

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Abstract

This research paper investigates the issues surrounding domestic pipe-borne water supply and distribution in Mile-Goma, a community within the Sabon-Gari Local Government Area of Kaduna State, Nigeria. The specific objectives of the study include identifying the sources of water supply in Mile-Goma, determining the factors that facilitate water supply and distribution, and pinpointing the challenges associated with water supply and distribution in the area. The research employs a survey research design, and the study population comprises the residents of Mile-Goma, estimated to be 2,219 in 2023. Fifty households were selected as the sample size for this study using purposive sampling techniques. Data was collected through a self-developed questionnaire administered via one-on-one interviews. Descriptive statistics were used to analyze the data, with frequency tables and percentages utilized to present the results. The findings of the study reveal several critical issues. It was observed that the water supply sources in Mile-Goma are limited, leading to water scarcity, particularly during the dry season. Furthermore, residents face challenges in storing water during the rainy season for use in the dry season, as sourcing water becomes increasingly difficult. To address these challenges and enhance the quality of water supply, the paper recommends several measures. The Kaduna State Water Board (KSWB) should take steps to increase water storage capacity to alleviate water scarcity during the dry season. Residents are encouraged to establish water reservoirs and storage tanks to collect and store water during the rainy season. Additionally, to improve the reliability of water supply, the government should ensure constant electricity supply or provide alternative power sources, such as generators. Lastly, the recruitment of skilled personnel within the water board is suggested to enhance the efficiency and effectiveness of water supply management.

Key words: Domestic Pipe Borne, Water Supply, Distribution, Mile-Goma

1. Introduction

Water is essential for life and has always been crucial for human survival, including activities like farming, raising animals, drinking, and transportation. (Ahile, 2015) Water is essential for the biosphere. However, it is not evenly distributed, and demand exceeds supply in many regions. (Falkenmark & Rockstrom, 2014). Nevertheless, an adequate, reliable, clean, accessible, acceptable and safe source of water supply should be available (Bos, 2016). In the developing world, water infrastructure is poor and many people do not have access to potable water and where available, clean and safe drinking water is inadequate for human consumption and other uses, such as for domestic and agricultural purposes (Cosgrove & Loucks, 2015). Consequently, in as much as water is an essential component of the planetary life support system, a lack of water is a problem that needs to be addressed for socio-economic development (Falkenmark, 2013). The problem of potable water shortage has

become a source of concern in the world; locally and globally, underpinned by the United Nations Sustainable Development Goals 6 (SDG-6) geared at providing access to clean drinking water for all and highlighting its importance to hygiene and the prevention of diseases (Schyns,2015).

Nigeria has an estimated 267 billion cubic meters of surface water and 92 billion cubic meters of groundwater per annum, with over 200 functional and silted dams with a combined storage capacity of 34 billion cubic meters. However, despite the huge water potential, the country is still classified as 'water deficit' because of its inability to meet the challenge of supplying potable water to meet the domestic needs of its people. Besides, the demand for potable water is set to increase with the rapid rate of population increase as well as urbanization. Only about 75 per cent (94 million) of the urban and 44 per cent (43 million) of the rural populations had access to improved drinking water sources, based on the population and water supply coverage of the country in the year 2008 (Ameto, 2018).

According to the National Human Development Report for Nigeria (NHDRN, 2019), 49.1% of Nigerians have access to improved sources of drinking water. However, over 70 million Nigerians still do not have access to improved domestic water supplies.

However, the 2013 official release from the Ministry of Water resources put the percentage of Nigerians with access to safe drinking water at only 32 per cent, showing a drastic decrease in availability of safe drinking water. Water Aid (2017) estimated that 57 million Nigerians still lacked access to basic sanitation and clean water in 2016.

According to UNICEF/WHO (2017), about 2.1 billion people worldwide gained access to improved sources of drinking water since 1990, thereby meeting the SDG target of having the percentage of the global population without access to water in 2015. The report also showed that, Nigeria missed the SDG target, with 69 percent of Nigerians having access to improved water supply and less than 25 per cent of Nigerians using safely managed drinking water services.

In Kaduna State, the major water supply problems faced by the households include inadequate supply, distance to the source of water supply and irregularity in supply from the sources as well as water being supplied from various sources. The implication of this is that although the various sources of water supply in the study area include hand dug wells, boreholes, Kaduna State Water Board, water vendors and streams, differences in the sources vary significantly from area to area. According to Orebiyi, (2013), about 52% of residents in Kaduna state do not have access to improved drinking water supply as for most communities the most secure source of safe drinking water is pipe-borne water from municipal water treatment plants. Often, most of water treatment facilities do not deliver or fail to meet the water requirements of the served community; due to corruption, lack of maintenance or increased population. The scarcity of pipe water has made communities to find alternative sources of water: ground water sources being a ready source. Wells are a common ground water source readily explored to meet community water requirement or make up the short fall (Nura & Sabo, 2017). This is the situation in Mile Goma Sabon-Gari Area of Kaduna State necessitate this research with a view to finding lasting solutions. The study aims to determine where the water supply in the Mile Goma Sabon-Gari Local Government Area of Kaduna State comes from, understand the factors that contribute to the supply and distribution of water in the area, and identify the challenges related to the supply and distribution of water.

2. The Study Area

Sabon-gari Local Government Area is located on latitude 11°10'N to Latitude 11°30'N and Longitude 7°35'00 to Longitude 7°50' E of GMT. The study area is about 686m height above sea level. Sabon-gari local government has a tropical savanna climate (Köppen climate classification *Aw*) with warm weather year-round, a wet season lasting from April to September, and a drier season from October to March. The natural vegetation of the area is typically Northern Guinea Savannah. A 2020 study found that barren land decreased from 1990 to 2020 while built environment increased 66 percent and vegetative land increased by 29% (Koko, 2020). Vegetation had been decreasing from 1990 to 2005. The study area found a dramatic increase due to agriculture and reforestation afterwards. The main study area is the Mile Goma of Sabon-Gari LGA that started from Shika sub-settlement in the North to Bomo sub-settlement in the East (see Figure1). Published geological information indicates that the undifferentiated basement complex of Migmatites, granites, gneisses, and meta sediments is overlaid by laterites (Muhammad et al., 2015). The Mile Goma Area also have a partial link to ABU Dam, Other major land uses are residential and agricultural. The drainage system of the area comp rise River Galma with its tributaries as River Shika, Saye, Yashi and Kubanni which are intermittent or seasonal in character and dendritic in nature (Mortimore, 1970).

The Zaria area is a dissected point of north central plains, an extensive peneplain in developed loamy stalline by stalling metamorphic rocks of the Nigerian basement complex. Residual granite inset bergs, the largest of which is Kufena hill, provide the main relief and there are 100 quartzite fidgets in the west.

Higher up the slope, the drainage Condition improves and the soils are generally reddish in color, metals are completely absent or a few may occur at great depth, iron concentrations are also not common. Lower down the slope, the soil gradually become greyer in color while the mottled horizon occurs nearer to the surface. The number of iron concentrations also increase and in some places an iron pan can be seen out roping at lower slops positions. This indicates that iron is not only moved vertically down the profile, but also laterally down the slope.

Locally, in lower slope positions some grey clay soils have been formed. These have a strongly developed coarse blocky structure and may contain calcium carbonate concentrations. The reason why these soils occur here cannot yet be fully explained. They may be influenced by local differences in parent rock or they may have been formed under a previous drier climate.

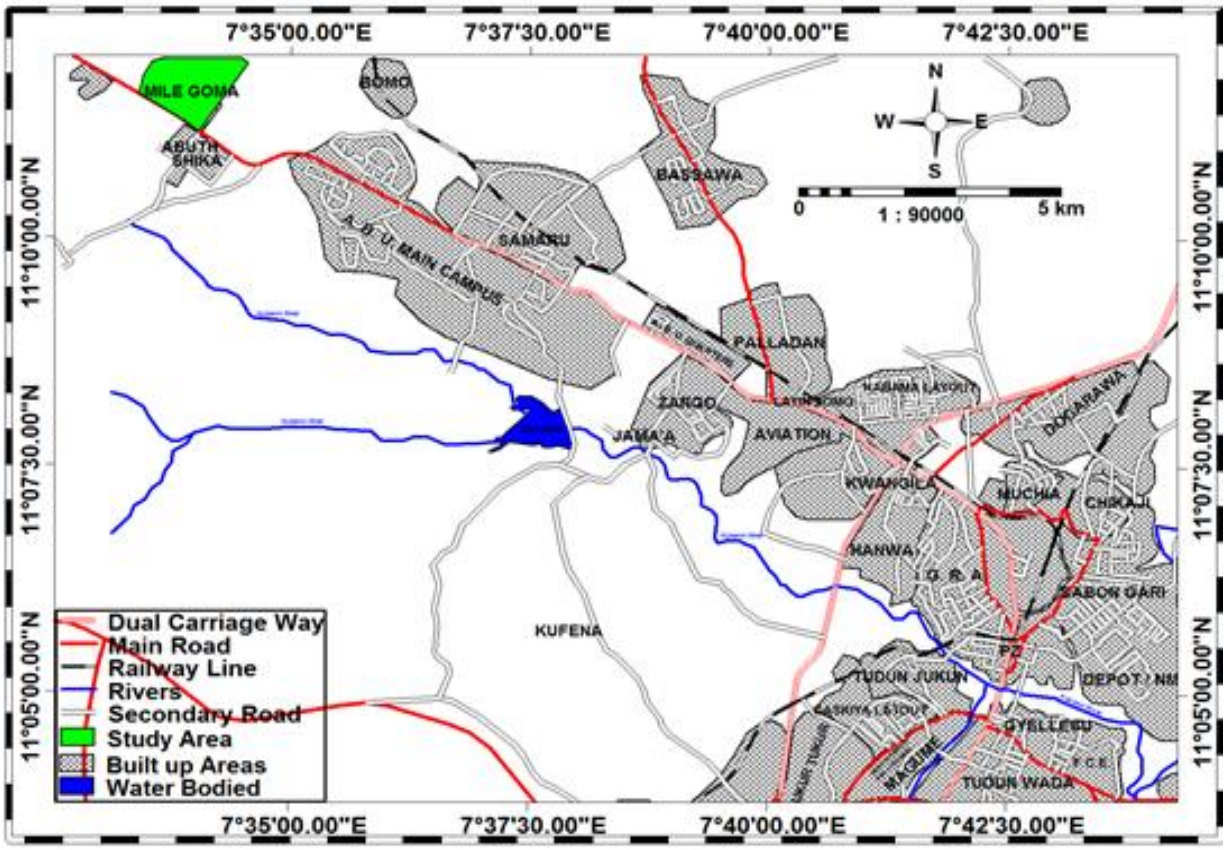

Figure 1: Mile Goma,
Source: Adapted from administrative map of Kaduna state, 2022

3. Methodology

The population use for this study is Mile Goma Sabon-Gari Local Government Area of Kaduna State which has an estimated

population of about; 393,300 according to 2006 population census. In order to obtain a reliable data in the course of the study, the researchers selected Fifty (51) Households from Mile Goma area to represent the sample size for this research.

In order to get a good representation of target population from all spheres of the study area, a purposive sampling was adopted.

In order to properly investigate the problem of domestic pipe borne water supply and distribution in Mile Goma Sabon-Gari Local Government Area of Kaduna State, the researchers closed and open-ended questionnaire as the instrument for data collection. The instrument was administered on a one-to-one contact with the respondents. The data collected from the respondents was analyzed using descriptive statistics such as Tables of frequencies and percentages to depict the information

4. Results and Discussion

4.1 Socio-economic Characteristics of the Respondents

Table 1 presents the Socio-economic Characteristics of the Respondents such as gender, age, and education level of the respondents.

Table 1 Socio-economic Characteristics of the Respondents (n=51)

Gender	**Frequency**	**Percentage**
Male	34	66.7
Female	17	33.3
Age	Frequency	Percentage
Less than 20 years	14	27.4
21- 30	6	11.8
31- 40	11	21.7
4 1 – 50 above	20	39.2
Education	Frequency	Percentage
Primary	11	21.6
Secondary	24	47
Tertiary	9	17.6
Quranic	7	13.7
Marital staus	Frequency	Percentage
Single	12	23.5
Married	20	39.2
Divorced	9	17.5
Widowed	10	19.6
Occupation	Frequency	Percentage
Civil Servant	15	29.4
Business and Trading	24	47
Farming	7	13.7
Others	5	9.8
Family Size	Frequency	Percentage
2-5	22	43.1
6-9	18	35.2
10-13	6	11.8
14 and above	5	9.8

Source: Field Survey, 2022

4.2 Frequency of access to water supply

The table 2 presents information on how many days in week respondents get access to water. Some of the perimeters to measure this are; 1-2days, 3-4days, 5-6days, Weekly.

Table 2: Frequency of access to water supply

Items	**Frequency**	**Percentage**
1-2days	18	35.2
3-4days	5	9.8
5-6days	6	11.8
Weekly.	22	43.1
Total	**51**	**100**

Source: Field Survey, 2022

Table 2 indicates that (35.2%) have access to tap water supply between 1 – 2days, (9.8%) have access to tap water supply between 3 – 4days, (11.8%) have access to tap water supply between 5 – 6days. While, (43.1%) have access to tap water supply weekly. Therefore, this implies that the majority of the respondents with 43.1% have access to tap water supply weekly.

4.3 Duration of Access to water supply

Table 2 presents the information on how long residents receive the water supply by Water Board Service

Table 3: Duration of Access to water supply

Items	Frequency	Percentage
Less than 2hrs	26	50.9
Less than 4 hrs	19	37.3
Between 5hrs and above	6	21.6
Total	**51**	**100%**

Source: Field Survey, 2022

Table 3 indicates that (50.9%) receive water supply for less than 2hrs, (37.3%) receive supply of tap water for less than 4 hrs., and (21.6%) of the respondents receive supply of tap water for between 5hrs and above. Therefore, this implies that the majority of the respondents with 50.9% receive supply of tap water between 5hrs and above.

4.4 The sources of drinking water in the study area

The Table 4 presents the various sources of water in the study area.

Table 4: Sources of drinking water in the study area

Options	Frequency	Percentage
Personal Tap Water	7	13.5
Public Tap Water	9	17.6
Personal Borehole	3	5.9
Stream/Rival Water	8	15.7
Personal Well Water	16	31.4
Public Well	8	15.7
TOTAL	**51**	**100**

Source: Field survey, 2022

Table 4 shows that (13.5%) of the respondents use tap water inside their houses as a source of drinking water, (17.6%) of the respondents use public tap water as a source of drinking water, (5.9%) of the respondents use borehole inside their houses as a source of drinking water, (15.7%) of the respondents use public borehole as a source of drinking water. While, (31.4%) of the respondents indicate they use well inside their house as a source of drinking water, and (15.7%) of the respondents use public well as a source of drinking water. This

implies that majority of the respondents with 31.4% use well water inside their house as a source of drinking water.

4.5 Common sources of water in the dry season

Table 5 presents the sources of water during the dry season in the study area.

Table 5: Common sources of water in the dry season

Options	Frequency	Percentage
Personal Tap Water	4	7.8
Public Tap Water	6	11.8
Personal Borehole	3	5.9
Stream/Rival Water	13	25.4
Personal Well Water	11	21.5
Public Well	14	27.4
TOTAL	**51**	**100**

Source: Field Survey, 2022

Table 5 shows that (7.8%) of the respondents uses tap water inside their house as source of water during dry season, (11.8%) of the respondents uses public tap water as source of water during dry season, (5.9%) of the respondents uses borehole inside house as source of water during dry season, (25.4%) of the respondents uses public borehole as a source for water during dry season. While, (21.5%) of the respondents indicate they uses well inside their house as a source of water during dry season, and (27.4%) of the respondents uses public well as a source of water during dry season. This implies that majority of the respondents with 27.4% use public well as a source of water during dry season.

4.6 Common sources of water during the rainy season

The table 6 presents the sources of water during the rainy season in the study area.

Table 6 Common sources of water during the rainy season

Options	Frequency	Percentage
Personal Tap Water	8	15.6
Public Tap Water	5	9.8
Personal Borehole	3	5.8
Stream/Rival Water	17	33.3
Personal Well Water	13	25.4
Public Well	11	21.5
TOTAL	**51**	**100**

Source: Field Survey, 2022

Table 6 shows that (15.6%) of the respondents uses tap water inside their house as source of water during rainy season, (9.8%) of the respondents use public tap water as source of water during rainy season, (5.8%) of the respondents uses borehole inside their house as source of water during rainy season, (33.3%) of the respondents uses public borehole as a source for water during rainy season. While, (25.4%) of the respondents indicate they uses well inside their house as a source of water during rainy season, and (21.5%) of the respondents use public well as a source of water during rainy season. This implies that majority of the respondents with 33.3% uses public borehole as a source of water during rainy season.

4.7 The distances to the sources of water from your household

Table 7 presents the distance respondents walk to sources for water.

Table 7 The distances to the sources of water from your household

Options	Frequency	Percentage
Within 200metres	13	25.5
More than 200metres	15	29.4
1 Kilometer	14	27.5
More than 1 Kilometer	9	17.6
TOTAL	**51**	**100**

Source: Field Survey, 2022

Table 7 shows that (25.5%) of the respondents walk 1 – 5 miles' distance to source for water, (29.4%) of the respondents walk 1 – 10 miles' distance to source for water. While, (27.5%) of the respondents walk 1 – 15 miles' distance to source for water, and (17.6%) of the respondents walk 1 – 20 miles' distance to source for water. This implies that majority of the respondents with 29.4% walk 1 – 10 miles' distance to source for water.

4.8 Regularity in the tap water supply

The Table 8 describes how often the respondents get tap water for domestic uses in the study area.

Table 8 Regularity in the tap water supply

Options	Frequency	Percentage
24hours in day	-	-
Daily	2	3.9
Weekly	4	7.8
2 time per week	21	41.1
3 time per week	8	15.6
Irregular	16	31.3
TOTAL	**51**	**100**

Source: Field Survey, 2022

Table 8 shows that (3.9%) of the respondents get tap water supply daily in the study area, (7.8%) of the respondents get tap water supply weekly in the study area, (41.1%) of the respondents get tap water supply 2 time per week in the study area. While, (15.6%) of the respondents get tap water supply 3 time per week in the study area, and (31.3%) of the respondents get tap water supply irregularly in the study area. This implies that majority of the respondents with 41.1% get tap water supply irregularly in the study area.

4.9 Factors enhancing supply and distribution of water in the study area

Table 9 represents the factors enhancing supply and distribution of water in the study area.

Table 9 What are the factors enhancing supply and distribution of water in the study area?

S/N	Statement	SA	%	A	%	D	%	SD	%
1	Adequate rainfall within the state	16	31.3	8	15.6	21	41.1	6	11.7
2	Constant electric power supply in the study area	13	25.4	11	21.5	16	31.3	11	21.5
3	High water storage facilities at the water board	18	35.2	9	17.6	13	25.4	11	21.5
4	Availabilities of manpower	23	45.1	6	11.7	9	17.6	13	25.4
5	Renovation and new construction of water Dam within the state	4	7.8	27	52.9	13	25.4	7	13.7

Source: Field Survey, 2022

Row 1: Table 9 indicates that (31.3%) of the respondents strongly agreed that there is adequate rainfall within the state, (15.6%) of the respondents agreed with the statement. While, (41.1%) disagreed and (11.7%) of the respondents strongly disagreed that there is adequate rain fall within the state. This implies that majority of the respondents (41.1%) disagreed that there is adequate rainfall within the state.

Row 2: Table 9 indicates that (25.4%) of the respondents strongly agreed that constant electric power supply in the study area enhance the supply and distribution of water, (21.5%) of the respondents agreed with the statement. While, (31.3%) disagreed and (21.5%) of the respondents strongly disagreed that constant electric power supply in the study area enhance the supply and distribution of water. This implies that majority of the respondents with 31.3% disagreed that constant electric power supply in the study area enhance the supply and distribution of water.

Row 3: Table 9 indicates that (35.2%) of the respondents strongly agreed that high water storage facilities at the water board enhance the supply and distribution of water, (17.6%) of the respondents agreed with the statement. While, (25.4%) disagreed and (21.5%) of the respondents strongly disagreed that high water storage facilities at the water board. This implies that majority of the respondents (35.2%) strongly disagreed that high water storage facilities at the water board enhance the supply and distribution of water in the study area.

Row 4: Table 9 indicates that (45.1%) of the respondents strongly agreed that availabilities of manpower enhance supply and distribution of water supply, (11.7%) agreed with the statement. While, (17.6) disagreed and

(25.4%) of the respondents strongly disagreed that availabilities of manpower enhance supply and distribution of water supply. This implies that majority of the respondents with 45.1% agreed that availabilities of manpower enhance supply and distribution of water supply.

Table 9 indicates that (7.8%) of the respondents strongly agreed that renovation and new construction of water Dam within the state, (52.9%) agreed with the statement. While, (25.4%) of the respondents disagreed and (13.7%) strongly disagreed that Renovation and new construction of water Dam within the state will enhance supply and distribution of water supply. This implies that majority of the respondents with 52.9% agreed that Renovation and new construction of water Dam within the state will enhance supply and distribution of water supply.

4.10 The Challenges associated with supply and distribution of water in study area

Table 10 is generated from a closed ended questionnaire which shows the problems associated with supply and distribution of water in study area.

Table 10 The challenges associated with supply and distribution of water in study area?

S/N	Statement	SA	%	A	%	D	%	SD	%
1	There is iron content in the tap and borehole water due to metals pipe rust.	19	37.2	14	27.4	12	23.5	6	11.7
2	Sanitary conditions of pipe borne water are bad due to bad drainage and carnal system in the study area.	10	19.6	24	47.0	7	13.7	10	19.6
3	There is shortage in water supply due to seasonal nature of rainfall in the study area	25	49.0	15	29.4	6	11.7	5	9.8
4	Poor financing of the water board on the part of the government affects water supply in the study area.	11	21.5	18	35.2	14	27.4	8	15.6
5	Inadequate power supply to pump the water for distribution.	20	39.2	15	29.4	10	19.6	6	11.7

Source: Field Survey, 2022

Row 1: Table 10 indicates that (37.2%) of the respondents strongly agreed that there is iron content in the tap and borehole water due to metals pipe rust, (27.4%) of the respondents agreed with the statement. While, (23.5%) disagreed and (11.7%) of the respondents strongly disagreed that there is iron content in the tap and borehole water due to metals pipe rust. This implies that majority of the respondents with 37.2% strongly agreed that

there is iron content in the tap and borehole water due to metals pipe rust.

Row 2: Table 10 indicates that (19.6%) of the respondents strongly agreed that Sanitary conditions of pipe borne water are bad due to bad drainage and carnal system in the study area, (47.0%) of the respondents agreed with the statement. While, (13.7%) disagreed and (19.6%) of the respondents strongly disagreed that Sanitary conditions of pipe borne water are bad due to bad drainage and carnal system in the study area. This implies that majority of the respondents with 47.0% agreed that Sanitary conditions of pipe borne water are bad due to bad drainage and carnal system in the study area.

Row 3: Table 10 indicates (49.0%) of the respondents strongly agreed there is shortage in water supply due to seasonal nature of rainfall in the study area, (29.4%) of the respondents agreed with the statement. While, (11.7%) disagreed and (9.8%) of the respondents strongly disagreed that there is shortage in water supply due to seasonal nature of rainfall in the study area. This implies that majority of the respondents with 49.0% agreed that there is shortage in water supply due to seasonal nature of rainfall in the study area.

Row 4: Table 10 indicates that (21.5%) of the respondents strongly agreed that poor financing of the water board on the part of the government affect water supply in the study area, (35.2%) of the respondents agreed with the statement. While, (27.4%) disagreed and (15.6%) of the respondents strongly disagreed that poor financing of the water board on the part of the government affect water supply in the study area. This implies that majority of the respondents with 35.2% agreed that poor financing of the water board on the part of the government affect water supply in the study area.

Row 5: Table 10 indicates that (39.2%) of the respondents strongly agreed that inadequate power supply to pump the water for distribution, (29.4%) of the respondents agreed with the statement. While, (19.6%) disagreed and (11.7%) of the respondents strongly disagreed that inadequate power supply to pump the water for distribution. This implies that majority of the respondents with 39.2% strongly agreed that inadequate power supply to pump the water for distribution.

5. Conclusion

Based on the findings of the research work, it can be concluded that the residents of Mile Goma Sabon-Gari Local Government Area source their water majorly from well water, it was discovered that majority of the respondents have well in the house as the major source of water, but only few have borehole and tap water within their resident, this could be as a result that borehole water and tap water are expensive to generate. Findings of the study suggest the following factors could enhance supply and distribution of water in the study area, which include adequate rainfall within the state; constant electric power supply in the study area, high water storage facilities at the water board, and availabilities of manpower, renovation and new construction of water Dam within the state. The study has also revealed that well water is the most common available to residents of Mile Goma Sabon-Gari Local Government Area this could be to factors that limit the supply and distribution of water supply in Mile Goma Sabon-Gari Local

Government Area such as present of iron content due to rust of pipe, bad sanitary condition of pipe and well, seasonal rainfall of the area due to it geo-graphical location, poor financing from the government, and inadequate power supply to pump water in to reserve tank.

6. Recommendations

Based on the findings of the study the research recommends that:

i. Kaduna State Water Board (KSWB) should create more thanks to save water, this would help to solve the problem of water scarcity during the dry season. Residents should also make available reservoir and water thank to store water during the raining season to be used at the dry season when sourcing water is usually difficult to get water
ii. In-order to improve the quality of water supply in the study area government should provide constant electricity and alternative to power supply such as the provision of a power generator. It is also recommended that competent manpower should be employed to work in the water board.
iii. The State and the Federal Government should create Policy that would enhance better water and sanitation improvement, that could help in solving the problem associated to supply and distribution of water in the country at large

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