



**FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA  
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION**

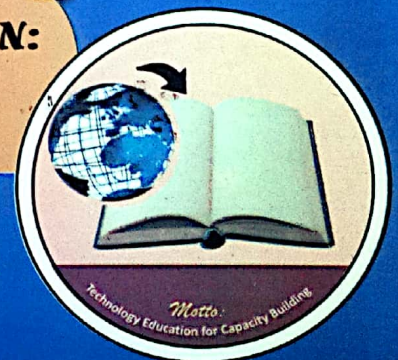


# Conference Proceedings

**THEME**

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IMPLICATIONS FOR  
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## Assessment of the Effect of Human Activities on Quality and Distribution of Water Supply in Minna and its Environs, Niger State, Nigeria

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### Abstract

Water is the most vital natural resources that nature provides. What we grow, where we live or build depend to a large extent on water and it determine the survival of plant and animal on the earth surface. Therefore there is a strong relationship between man's activities and water. Access to portable water in Minna has been continuous decrease since 1980s, on the average, 20% of the inhabitant of the area currently have access to water supply. The problem of inequality of water infrastructural provision remain unsolved, however the rate at which infrastructural services like provision of water is being provided is grossly inadequate in meeting the population demand in Minna. The main aim of this research is to identify, examine and explain the various human activities which affect the distribution of water resources and supply in order to ascertain its availability throughout the subsequent years to come. The data for the study were collected through primary and secondary method, which involve questionnaire, oral interview, library materials, laboratory result of water quality analysis from Niger State water Board. Data obtained from the field work and Nigeria Meteorology Agency were collected and analysed. The result of the study reveals that availability of water in the study area is affected by human activities, increase in population growth, urbanization and agricultural activities, which result also shows that water is mismanaged and absence of full maintenance, there is general reduction in rainfall over the study period (2004-2014). On the basis of the present study, we recommend that, the state and local government involve must establish a state water policy office whose activities would include policies, data collection, policy coordination, project identification, financing, research, control of point and nonpoint of pollution and development.

**Keywords:** Water quality, Human activities and Water supply

### Introduction

Good quality water is odourless, colourless, practically tasteless and free from pollution (Ezeugwunne, 2009). It is one of man's priceless resources but generally taken for granted until its use is threatened by reduced availability or quality. Environmentally, water is so important that its pollution becomes a serious problem since it affects the lives of many people throughout the world.

In the world, about 1.1 billion people do not have access to improved water supply while 2.4 billion do not have access to improved sanitation facility. In addition, over 2 million people, mostly children of less than 5 years age mainly from developing countries with poor implementation of sustainable water programmed, die every year of diarrhea diseases (WHO, 2011). Therefore, in order to accelerate development while enhancing environmental sustainability, it is opined that the proportion of people without access to sustainable safe drinking water and basic sanitation in the world should be reduced to half by the year 2015 (Teshamulwa, 2007). This is achievable only when water is supplied in its wholesome form from various sources such as well, boreholes, springs, pipes, rivers and even the packaging factories. Because population growth will probably add another 2.5 to 6.6 billion people over the next 25 years, which will be mainly in developing countries (Basterimeijert, Wegelin and Brikke, 2000). However, despite the growth in world's population, there is no equal increase in safe water supply to match the population. For instance, over one billion people in the world lack access to adequate water supply (Hueb, 2000).



Furthermore, low income earners in urban areas are deprived of provision of good water services and have to pay exorbitant prices set by private vendors for small quantities of water of doubtful quality. It is however, necessary to make water available in the required quantity and quality in order to meet the demands of the various users especially in third world countries.

Therefore, water supply in Minna is facing serious challenges such as inadequate expansion of water supply infrastructure which are stressing the population of most communities below satisfactory level. Balogun (2001) observed that since independence many water supply schemes have been and are still being commissioned to satisfy political promises and aspirations without resources management viewpoint. In view of this lack of achievement, this study intends to assess the effect of human activities on distribution of domestic water supply in Minna with a view to suggest improvement specifications for a sustainable water resource management.

### Statement of the problems

Regular supply of water solves both the environmental and managerial problems. Thus constant water supply will bring about improved living standards in Minna, the problems of water supply are glaring and manifest themselves in three different forms. The inadequacy of water is evidenced by the number of people seen in the available streams looking for water whose quality is quite doubtful; this bring to the problems associated with water such as cholera, diarrhea and guinea worm infections. The major problem cause by climate in a region like that of northern Nigeria is the seasonality of weather condition where the long period of dry season will mean the absence of rainfall and thus which make inadequate water supply. The research intends to come up with possible relationship that exists between human activities and water supply, also how rainfall that changes over time affect water supply and quality.

The water needed to be supplied by all the sources of water in the study Area including water Board, boreholes, wells, streams and raining water. Niger State Water Board (NSWB) is the sole supplier of tap water in Minna and is just supplying 25.78% of the water at the moment which is (4,851,306.18 liters per day or 1,261,339.607 gallons per day) of the total water requirement needed in the study Area. Thus other sources of water augment the remaining water needs of (14 million liters per day or 4 million gallons per day), these as show that there is shortage of water supply in the study Area and which we the planner need to solve it due to our future planning (vision 3:20:20). Access to portable water in Minna has been in continuous decrease since 1980s. On the average, less than 20% of the inhabitants of the area currently have access to portable water. In spite of various laudable policies being put in place by the successive governments to ensure that access to adequate portable water supply is made possible, the problem of inequality of water infrastructural provision remain unsolved. However, the rate at which infrastructural services like provision of water is being provided is grossly inadequate in meeting the population demand in Minna. The problem most neighbourhood in Minna are combating with, is that households demand for water from different sources with no regard for its quality. Demand level and the quantity of the sources are being currently polluted as a result of natural and human interference. The aim of this study is to assess the effect of human activities on distribution of domestic water supply with a view to identifying the problems and proffering possible solutions. The specific objectives of this work are to examine the conditions of the existing water supply sources, identify the various human activities affecting water distribution, examine the impact of these activities on water quality and examine the variability pattern of rainfall over the periods of (2004-2014).

### Study Area

Minna is the capital of Niger State. The study area lies between Latitude  $9^{\circ} 33'$  and  $9^{\circ} 4'$  North, and Longitude  $6^{\circ} 29'$  and  $6^{\circ} 35'$  East on a geological base of undifferentiated basement complex of mainly gneiss and magnetite. At the North east corridor of the town lie a continuous steep outcrop of granite, which form a limitation towards physical development in that axis. In the present political zoning system, it is within the North Central Zone, and occupies an area of about 884 hectares. It is about 145 kilometers by road from Abuja, the Federal Capital of Nigeria. The Minna metropolis has grown to engulf suburbs settlements such as Bosso, Maitumbi, Dutsen Kura, Kpakungu, Shango and Chanchaga. The climate of Minna is characterized by distinct wet and dry season. The wet (rainy) season starts in April and ends in October, with a maximum rainfall occurring in August. Presently, Minna enjoys a climate typical of the middle belt zone, Guinea savannah with distinct wet and dry seasons. The rainy season starts around April



and lasts till October. It has a mean annual rainfall of about 1334mm (52inches) with September recording the highest rains of about 00mm (11 inches). The mean monthly temperature is highest in March at 35°C towards eastern and western parts of the area. Because of these gigantic rocks, development has been halted by flat rock outcrop at the extreme parts. All developments follow the line of the rock, which was Fadamas of the larger rivers support savannah with occasional streams covered with dense riparian brand with some up to 16.5meters height. The trees are scattered, short

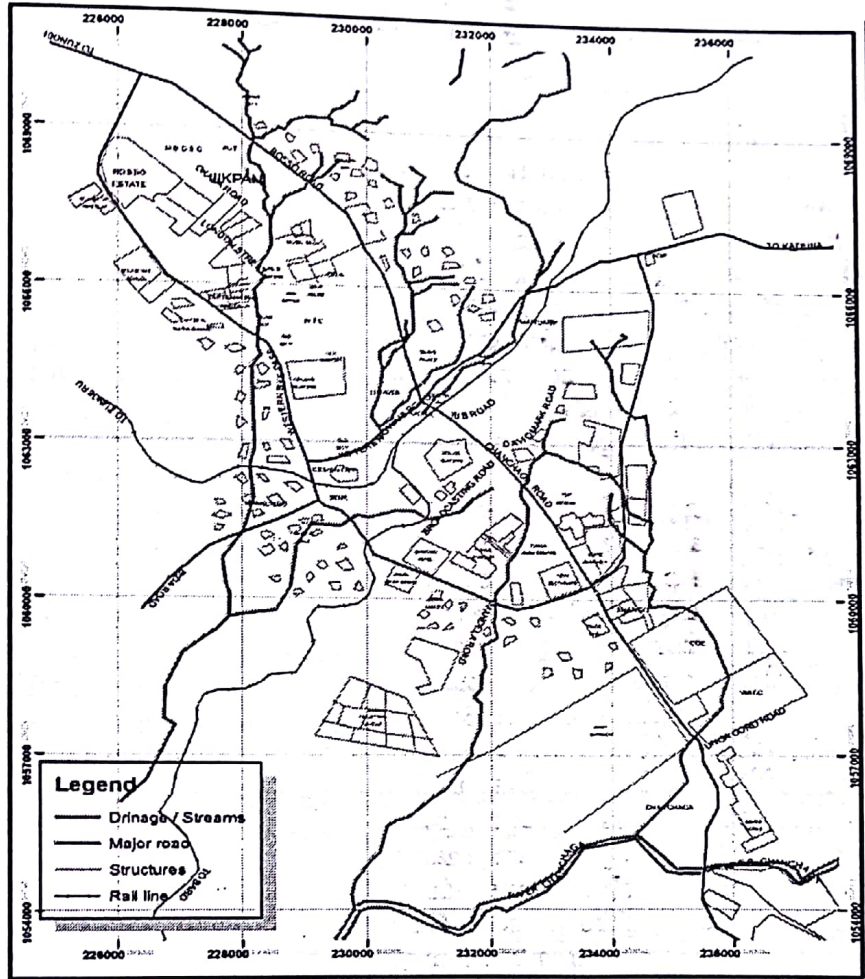


Figure 1: Minna Township Map

**Materials and Methods**

Two approaches were adopted which include derivation of information from unpublished (field) or primary and published (library) or secondary sources. The primary data is the most expensive but it has the advantage of completeness and accuracy in data collection and this method involves the following steps: Oral interview, Questionnaire and Direct observation. The secondary data consist of journals, magazine, books, natural resources and these are already exists and review of related literature on water and its importance are conducted through available materials on internet, libraries while the geographical, political and historical settings of the study area were obtained from Niger State Ministry of Land and Housing, Niger State Water Board and Water Resources. Rainfall data of 10years was collected from Nigeria Meteorological Agency, Minna Niger State. This source provides most data, if not all, of the information required. The secondary data have the following advantages which are: it save time, it save manpower and it save resources in sampling and data collection.

The results obtained in this study were presented graphically as well as pictorially in forms of pie charts, histograms and bar charts because it is more effective and easier to understand, It clearly show the differences or relationship between variables and it summarize large raw of data.

Descriptive Statistics was adopted for this study, Microsoft excels and Statistics Package for Social Scientist (SPSS, 20) was used in calculations as well as plotting of graphs.

Geometric progression formula was also used to determine the quality of water requirement for the study area:  $P_f = P_i (1 + r/100)^n$

Pf- Future Population=?

Pi - Initial Population = 188,181

R - Growth Rate = 3.6

n – Time tag between the initial and the future.

$P_f = 188,181(1+3.6/100)^{14}$

$P_f = 188,181(1.640, 727,947)$

$P_f = 308,754.$

Population in year 2020 = 308,754 approximately

The Average Water Need per person in a day = 100 liters or 26 gallons.

$308,754 \times 100 = 30,875,400.$  Liters per capital, per day.

$308,754 \times 26 = 8,027,604.$  Gallons per capital Per day.

Estimated water supply per capital in Minna currently =  $188,181 \times 26 = 4,892,706$  gallons

The drought index called standardized rainfall anomaly index (SRAI) adapted from Ifabiyi and Ojoye, (2013) was used to check the variability pattern of rainfall over the period of 10 years (2004-2014).

### Results and Discussion

This part consist of the existing situation of water supply facilities, the socio-economic characteristics of the respondents, the information on their water supply and their perception on the Niger State Water Board in the provision of tap Water, the laboratory results of the water qualities was also reveals and the quantity of water needed were determine through projection.

#### Examine the conditions of the existing water supply sources.

Table 1 shows 45% which stated that, it was less than 10 years when they have source of waters. 23.5% said it was between 10 to 20 years, 20.3% said it was between 21 to 30 years, 5.2% said it was between 31 to 40 years and 6% said that more than 40 years ago, when they started using the sources of water. The new developed Area from the responses shows that, they are using Niger State Water Board of recent and other sources of water, which is less than 10 years; the core Area was using wells and streams as there was no tap water source in the area

**Table 1: Duration use of the water source**

Duration	No of respondents	Percentage (%)
Less than 10 years	158	45
11-20 years	82	23.5
21-31 years	71	20.3
31-40 years	18	5.2
Above 40 years	21	6
Total	350	100

#### General opinion on existing water situation in Minna

Table 2 gives the general views of all the respondents on water board in Minna, which indicates 65.6% said that the board is ineffective, 20.2% claimed that it is effective, 10.2% said it is very ineffective while 4% opined that it is very effective. The management of water board state that the ineffectiveness of water



supply is due to insufficient, in terms of the regularity, the distribution and the quality of water supplied. The result of every good management system of any water board is the adequate provision of potable water. Therefore the main reasons for being ineffective are lack of funds, obsolete equipment, and poor payment of rates by consumers among others.

**Table 2: General opinion on existing water sources in Minna**

Opinion	No of Respondents	Percentage
Very effective	14	4%
Effective	71	20.2%
Ineffective	231	65.6%
Very ineffective	36	10.2%
Total	352	100%

**Estimation of water demand in the study area with projection to year 2020**

To get the amount of water demanded per capital per day, the quantity per household will be divided by the size, but due to differences in the size of household 100 liters per capital per day or 26 gallon per capital per day by (Dangerfiled, 1983) was used. And to determine the population of the study Area for the year 2020, Geometric progression formula were also used:  $P_f = P_i (1 + r/100)^n$

$P_f$  - Future Population = ?

$P_i$  - Initial Population = 188,181 (N.P.C, 2006)

R - Growth Rate = 3.6

n - Time tag between the initial and the future. Target years (2020 - 2006) = 14.

$P_f = 188,181(1 + 3.6/100)^{14}$

$P_f = 188,181(1.640, 727,947)$

$P_f = 308,754$ .

Population in year 2020 = 308,754 approximately

The Average Water Need per person in a day = 100 liters or 26 gallons.

$308,754 \times 100 = 30,875,400$ . Litres per capital, per day.

$308,754 \times 26 = 8,027,604$ . Gallons per capital, per day.

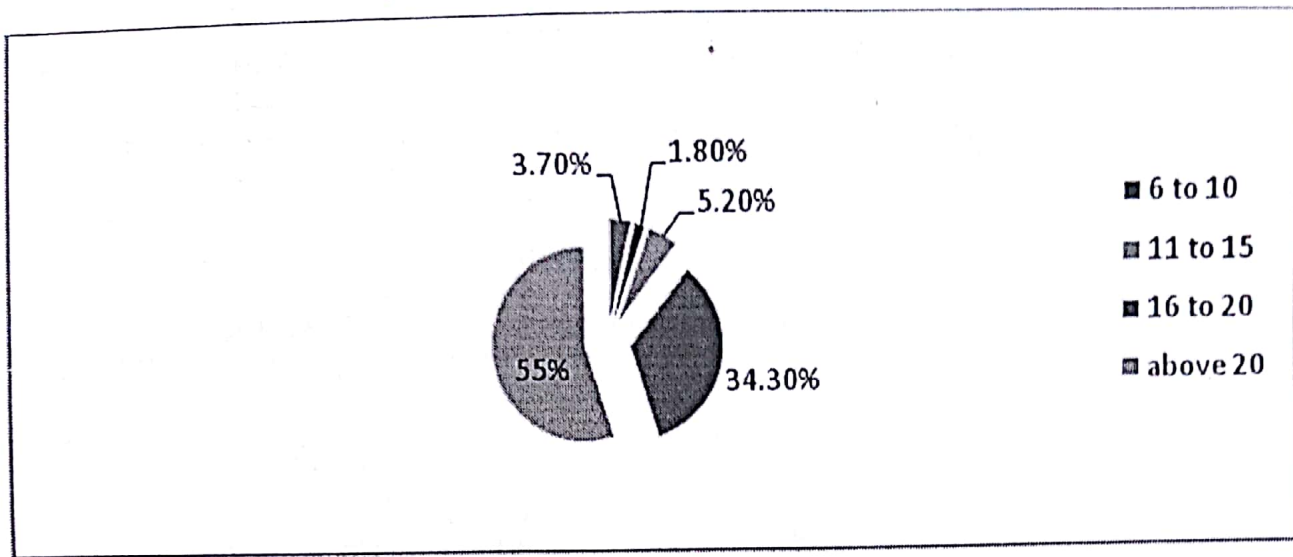
Thus: the present existing water capacity is approximately 6 million litres per day and the projected water needed in the study area for the year 2020 is 31 million litres per day. Then, the total shortfall of water in the study area are 31 million litres - 6 million litres = 25 million litres, for the years 2020. So we have to manage the available sources of water and improved on it for environmental sustainability of Minna.

**To identify the various human activities affecting water distribution**

These characteristics include educational level of respondents, distribution of number of people in the house against each segment number of households in the house, occupation of the respondents, the analysis of respondents connected to tap water, distribution of non-statutory sources of water, diseases suffered as a result of the use of water from non-statutory sources and respondents assessment of the performance of Niger State Water Board in Minna.

**Size of household**

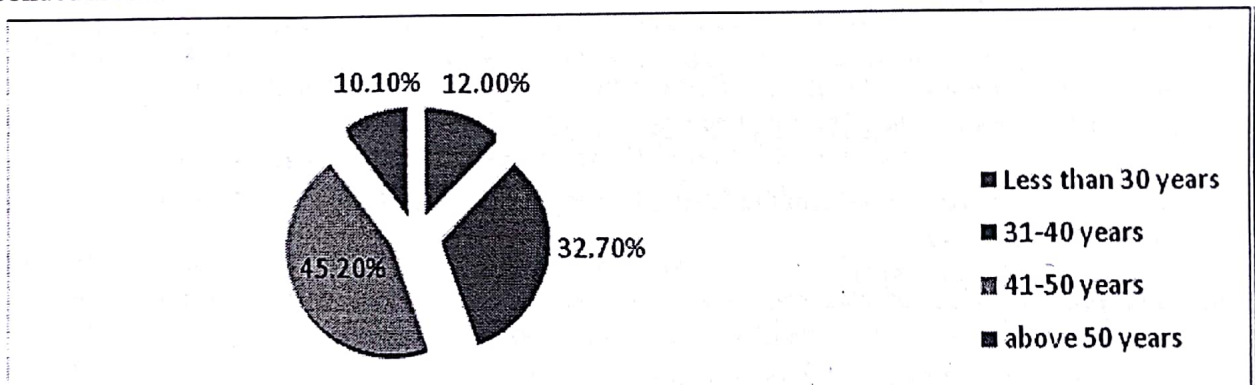
Figure 2 shows that, out of the three hundred and fifty two responses on this aspect, 55% of the respondents live in a house that contains between one to five households; this invariably makes it to be the most common households in the study area. Others include (34.3%) between six to ten household, 5.2% falls between 11 to 15 while household that falls 16 to 20 accounted for 1.8% and finally, 3.7% of the houses harbor more than 20 household. The above clustering of household in the study area enables easy distribution, provision and sharing of social facilities, including water which is our main point of concern.



**Figure 2: Size of Household**

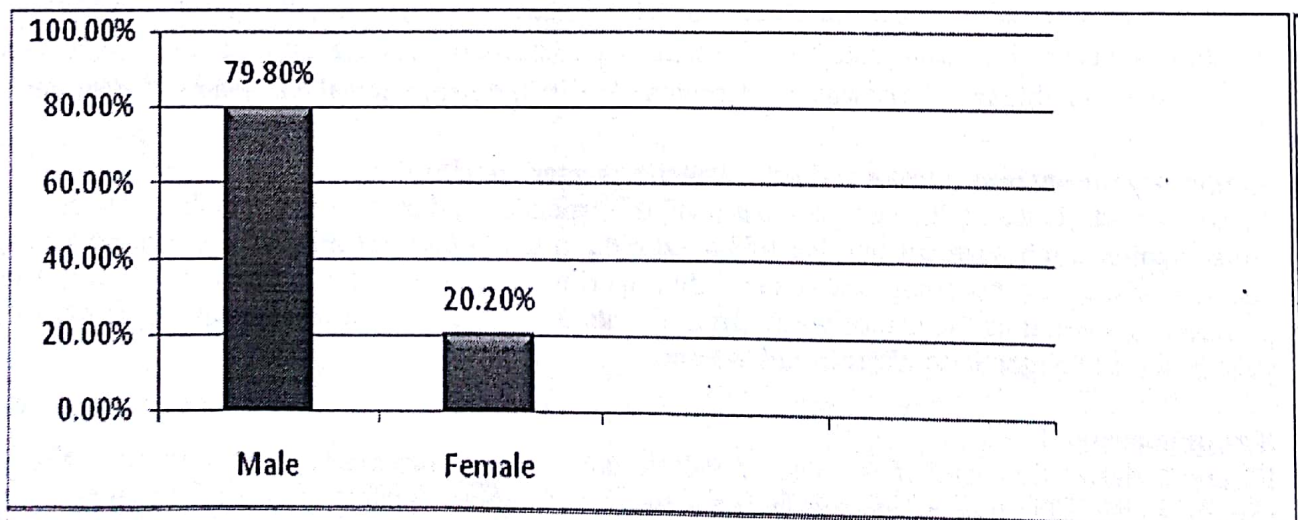
**Age, Sex and marital status of respondents**

The figure 4.3 result show that, 45.2% of the respondents are in the ages between 41 -50 years, 32.7% falls in between 31-40 years, 12% are less than 30 years while ages above 50 years have the least percentages which is 10.1% of the total respondents. The results show clearly that the categories of people who responded are adults and head of household.



**Figure 3: Age of Respondents**

Also, figure 4 shows that 79.8% of the respondents were male while 20.2% were female. This implies that the majority of respondent are head of the family. Moreover, figure 4.5 shows that the majority of respondent are married which accounted for 75.3% while the singles took 14.6%, the divorce have 3.2% and widowed were 6.9% respectively.



**Figure 4: Sex of Respondents**



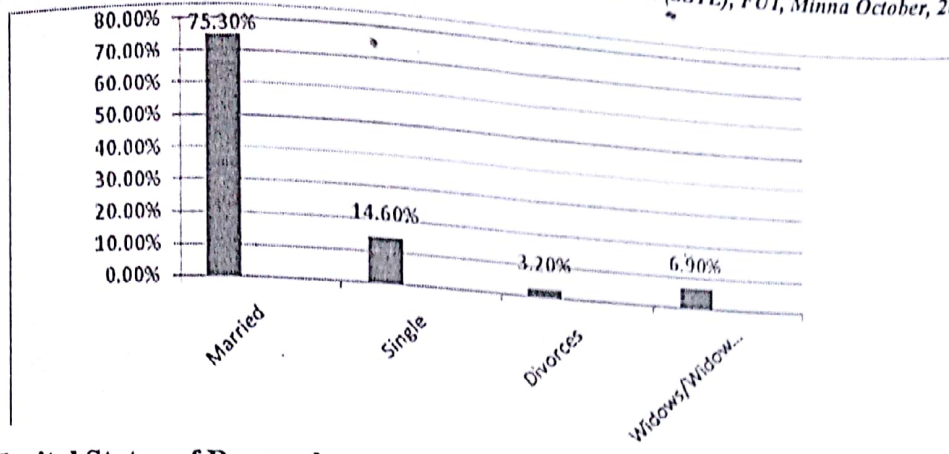


Figure 5: Marital Status of Respondents

**Source of water**

Figure 7 show source of water of the respondents, majority rely on pipe born water supply but the problem is that half of the population are not enjoying regular supply of water. They depend largely on other sources of water like well, buy water and borehole.

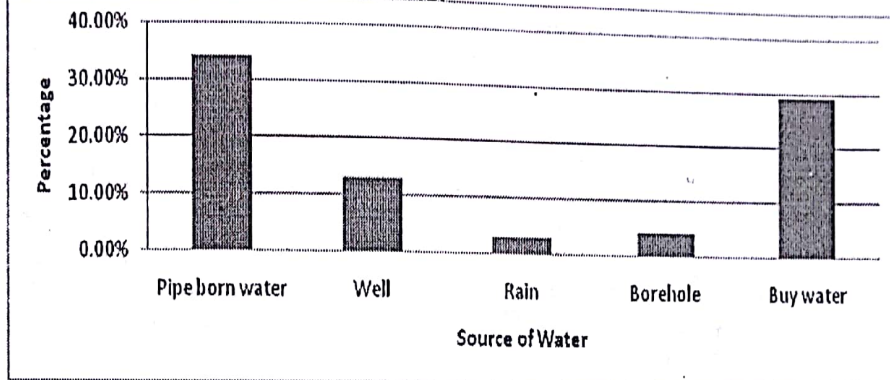


Figure 7: Source of Water

**Standardized Rainfall Anomaly Index (SRAI)**

The findings from the standard anomalies index revealed that year 2005 and 2013 was moderately dry, years 2006, 2007, 2008, 2009, 2010 and 2014 was near normal, 2012 was very wet. Throughout the study periods, rainfall amount was below normal. Implication of this is that when rainfall is insufficient, ground water recharge and recharge of streams and rivers would be reduced. This would bring about a reduction in well water as well as dam capacity which would then give rise to water shortage in the communities. And also as rainfall is very wet it implicate flooding, erosion and leaching which affect the quality and distribution of water supply in the study area.

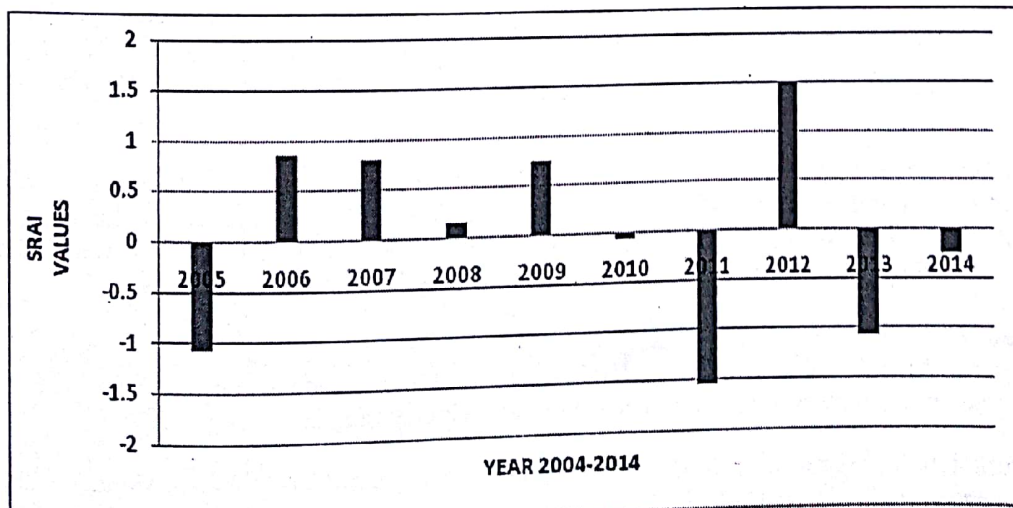


Figure 8: Rainfall pattern in Minna from 2004-2014



### Conclusion

Water is a very important known element for existence of mankind in any given environment and as such its availability cannot be played with. Its absence can cause not only physical and economical setback but it can also cause both sociological and physical set back in our environment.

Minna township is one place that have been struggling with the problem of water supply as the agency responsible for provision of portable water is incapacitated due to certain reasons discussed. The board is known not to be meeting the water need of the town and if not check in time, the board may only be able to meet just about 10% of the installed capacity which is just about 20% of the water need of the town. In conclusion therefore, effective management of both the statutory and non-statutory water supply must be integrated and the communities should be included into their planning and management schemes, this is the only way to ensure sustainable and sound water supply to the study area.

### Recommendations

Considering the importance of all the sources of water to the town on one hand and role of effective management in supply of safe and adequate water on the other, proposals/recommendations are discussed below in order to give the town sustainable water management outfit.

The first proposal or alternative towards achieving a very sound water management in the town is to allow the state government and voluntary organizations, such as the international agencies to form partnership in the funding and management of water in the state. It is assumed that under this proposal there will be two separate boards (Niger State Water Board and Non-statutory water supply board) which will be responsible for the management of pipe borne water and other sources.

The merits under this proposal include the counterpart funding by both government and international agencies which will reduce the financial burden on the government alone. The knowledge from the international agencies will be brought to bear on the management capacity of the boards. Also, the results from the laboratory analysis showed that other sources of water, except the pipe borne water and boreholes did not meet the WHO standards. Thus these agencies will also serve as regulatory organs for domestic water consumption in the study area.

The second proposal is the creation of independent bodies to manage statutory and non-statutory water sources. There should be an agency that would regulate and monitor development of boreholes while the Niger State Water Board should concentrate and manage tap water only.

This, if properly adhered to, will allow each body to channel its resources and energy to the aspect with which it is concerned giving rise to effective water supply. This will also ensure sustainability and community participation from the planning stage to management level.

Another recommendation includes the need to strengthen the State Water Board technically and financially in order to enable it carry out its functions as stipulated by the edict establishing the Board. Rules should also be flexible in order to amend edicts that establish water agencies in order to give room for more performance or enter into agreement with some international agencies to meet the modern challenges of sustainable water supply especially the Millennium Development Goals and the state vision 2020.

There is also need to increase the present treatment plants to at least eight in numbers by establishing four new and replacing the old four with new ones. Again there is also need to reduce the leakages along the network of the pipes from 45% to at least 10%. The board also needs to improve on their debt recovery system and improve on domestic, industrial and institutional water supply.

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