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Ground and Surface Water Potentials and Accessibility in Kano Municipal, Nigeria: Implication for Geological Constraints

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ABSTRACT

Kano State is located in the dry zone of northern Nigeria (buffer zone), and has for long been suffering from shortage of table water. Water shortage and pollution are universal problems but are acute in developing countries. The United Nation Water Decade (1980-1990) focused on developing countries and endeavored to encourage the increased investment by the governments and donor bodies on water projects. Fieldwork techniques, primary and secondary data were adapted to access and map out the ground and surface water potentials as well to determine the level of water accessibility in Kano municipal. The results demonstrated that the integration of collective duties in the assessment and management of water resources and development (of both ground and surface) exploration plans. Water in terms of availability, accessibility and quality was found to be inadequate in the study area. The research recommended that the provision of portable water should be provided, to ease that pressure and to create room for replenishment in next coming years. Mapping of the area was also recommended, to be fully integrated into ground and surface water studies for effective management and control.

Keywords: *Ground and surface water, Geological Constraints, Potentials, Accessibility, Kano Municipal*

INTRODUCTION

The extent to which water resources development contributes to economic productivity and social well-being is not usually appreciated, although all social and economic activities rely heavily on adequate quality or quantity of freshwater supply. Safe drinking water and basic sanitation are crucial to the preservation to human health, especially children. Water-related diseases are the most common cause of illness and death among the poor and developing countries.

Potable water distribution in Kano state is facing serious challenges because of rapid population growth, urbanization, budgetary constraints, corruption, and imperatives of development and social equity. Despite the huge capital invested in water supply projects, but still the supply is facing serious problems of growing population and development of new sources of water is increasingly become capital intensive. Rapid population increase in the study area is as a result of natural increase i.e. birth rate and migration from rural areas into Kano metropolitan and other urban centers in the state from different rural areas within and outside the state which lead to high concentration of people in the Kano metropolitan, which in turn affect the distribution of the portable water. Similarly, increase in income level raised living standard, which also lead to high water consumption. Definitely, increase in population will exert high pressure on available water resources and infrastructural facilities use for water supply, for different types of uses intended. Hence, there are needs to critically study water demand of the populace and the current supply, so as to know whether supply satisfy the demand or not, and what are the main constraints/ problems of potable water distribution.

The rapid growth rate of the population presently has significant impact on the portable water distribution in Kano municipal. Drought and rainfall seasonality are the main features associated with Sudano-Sahelian area (Sawa, 2002), these decreases in rainfall intensities and increasing dry season (Ojonigu, 1990). The combined effects of drought and high evaporation in the area, increases the water the deficit, which signifies scarcity (Salama and Okafor, 2003). The per-capita domestic water consumption when compared with the increasing population of the area has risen significantly this has already define an

increasing domestic water demand in an established low water supply.

The water work has three distinct phases, namely first, second and third Challawa water work. The first water work started in 1932 with capacity of supplying 20 million litres to the metropolitan of Kano. The second and third Challawa water works was established in the year 1974 and 1992 respectively with capacity of supplying 90 million liters to greater Kano each.

Scope and Area of Study

The study focuses on the problem of portable water distribution in Kano municipal local government area of Kano state. Kano municipal local government area have coordinates: 11° 57′ 07″ N / 8° 32′ 25″E / 11.95194°N 8.54028°E. It has an area of 17km2 and population of 365,525 at 2006 census. Due to financial constraint and limited time to complete the research, therefore, the research will be limited to some selected communities in the area.

Relief, Drainage and Hydrology

The area lies within the Hausa plain and highest elevation is in a village called Husure at eastern part of the area, about 564M above sea level and minimum elevation of 488M down south of the area and with an average height of 526M above sea level.Drainage in the area is largely influenced by the relief; low land areas have the rivers and streams. River Challawa is the only big river with tributaries, Magaga, Takwami, Guzu-guzu, Kutumbulu, Iyaka and some lakes. The rivers are now mostly demand and on river challawa the popular challawa Gorge dam was constructed in the year 1972. The area has a drainage densily of 1.46km/km2 as calculated by (Olofin 1991). The general pattern of drainage in the area is dendritic mostly running in the north south direction.The study area and part of the metropolis is drained by two major river systems The Jakara and The Kano River. The gentle slopes and undulating relief give the river a moderate to flowing character. Kano metropolis is divided in to two hydro-geological divide, to the west-south of divide is zone of high surface water discharge and retention which coincide with zone of basement complex structure.

Climate and Vegetation

The movement of maritime air masses originating from the Atlantic Ocean, influences the wet season which starts from May and ends in September. The commencement and length of the season in Ruruwai which is southern part of the state is six months from early May to late September. While in northern part it`s from June to early September.

The average rain fall is between 63.3mm ± 48.2mm in May and 133.4mm ± 59mm in august the wettest month. The movement of the tropical maritime air masses from the south west to the north determines the weather of Kano state during the wet season. This air mass carried a lot of moisture from over the Atlantic Ocean. This moisture condenses when it forced to rise by convection or over the barrier of highlands or an air mass; it then falls back as rain. The period of heights occurs when the sun is in the southern hemisphere and because of movement of the desiccating continental air mass, which originates from sahara area and blows from the northeast carrying along with it in the hamattan dust, and is the havesting season. (Connah, 1987).

The canopies of trees a very wide and most of them are less than 20m tall. Following are the common trees of Kano sate: Acacia albida (Hausa: gawo), Acacia nilo tica(Hausa:gabaruwa), boabo adanosia digitata (Hausa:kuka), angogeissus leiocarpus (Hausa:marke), neem aoedirachata indica (Hausa:dogon yaro), desert date Balanties aegyptica (Hausa: aduwa), ebony diospyros mespiliformis (Hausa:kenya), mahogany khaya senegalensis (Hausa:kardo), selecarya birrea (Hausa:dinya), ziziphus spina-christi (Hausa:kurna), (Nchol, 1988). These trees are very resistant to drought. It has been suggested that these products have been available as part of vegetable resources in West African savanna for two to three thousand years. Domesticated crops include sorghum, millet and African rice, several indigenous yams, two African ground nuts, cowpens and black beniseed (Connah 1987:101).

Geology

Geologically, more than four fifth of Kano is underlain by quartzite, undifferentiated Metasediments and basement complex rocks of the Precambrian origin. Prolonged weathering of the rock produced deep clayish regoliths which have been subjected to lateralization. The laterelitic out crops dot the inter flure areas of the upland plain serving as crops for regolith hills such as Gwauran Dutse and Dala hills.

Well jointed younger granites of Jurassic origin occur in ring complexes in the extreme south. A narrow strip of the chad formation occur to the east (Olofin, 1981). In height, the relief ranges from laoer plain (500m) to highlands of more than 1000M above sea level. The land forms include: Rishi hills plain with grouped hills; sandy plain and alluvial channel complexes.

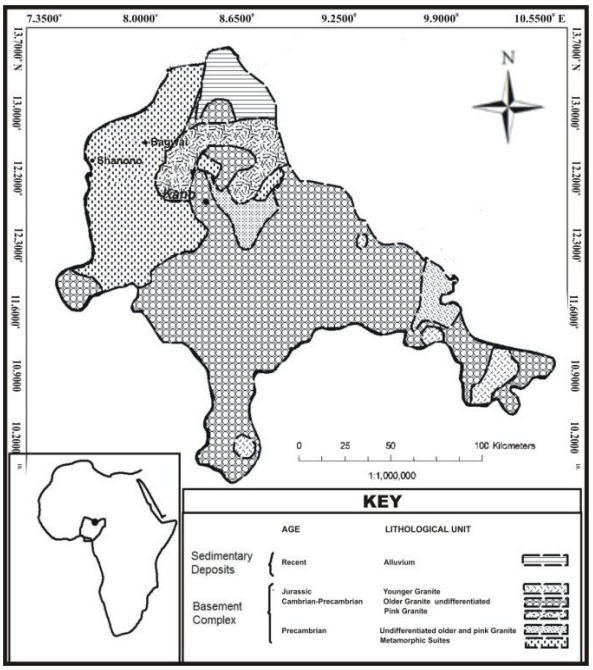

Figure1. *Geological map of Kano State*

METHODOLOGY

In this research work of evaluation of potable water distribution problem in Kano State particularly Kano municipal area, primary data is the major concern. Primary data for this research work on potable water distribution problem were sourced from questionnaire, oral interview, and field observation. While the secondary source of data includes the use of relevant literature concerning the subject matter and other published data. After successful completion of data collection from the study area on potable water distribution problem, descriptive statistics were used to analyze collected data. The total water demand in Kano municipal is obtained by finding the product of population figure of the area and the average daily per capita water consumption.

The primary source of data includes the use of questionnaire, oral interview, and field observation. While the secondary source of data includes the use of relevant literature concerning the subject matter and other published data. Questionnaire- open ended questionnaire has been used in conducting this research study. Also hundred numbers of questionnaires have been distributed within the study area. Oral interview- this source of information has helped in making good analysis. Field observation- this field observation has looked into the problems limiting portable water distribution in the study area.

On Secondary Data, Relevant literature concerning the subject matter and other published data those will help in bringing good information and understanding the causes of portable water distribution problem in the study area.

RESULTS AND DISCUSSION

Main Users of Portable Water in Kano State

Kano State has more than 12 million people (NPC, 2006) Kano urban centers attract large number of migrant from different parts of the country and abroad. In the 1960's rate of urban growth in Kano was about 3.1% annually. Between 1970 and 1980 urbanization rate was estimated to be 3.9%, presently the rate of urban growth in Kano is about 5.5%.

In addition, Kano is historically regarded as agricultural state and is very popular in groundnut production. The state has about 18,684 square kilometers (7,214 sq mi) of cultivable land and is the most extensively irrigated state in the whole Nigeria. So, agriculture is among the most significant sectors

of Kano State's economy. About 70% of the population is directly or indirectly engaged in agriculture and rely on agriculture as sources of their livelihood. The prominent food crops cultivated in Kano include millet, cowpeas, sorghum, maize, rice, groundnuts and cotton.

Kano River Irrigation Projects needs are presently estimated at 390 million cubic meters (mcm). Assuming an average annual available volume of 750 mcm, an annual quantity of 255 mcm will be provided to other downstream users. The average annual available volume of 750 mcm can cater the needs of all users but is only available for 60% of the time. Moderate to severe water shortage is anticipated 40% of the time. The dam guarantees smooth flow of about 60-70 MCM per month in the dry months (in the period which coincides with the peak demand of irrigation).

Moreover, Kano State has the percentages of industries in Northern Nigeria and it is the second in Nigeria after Lagos. Presently there are more than 400 privately owned industries in Kano producing different goods which include textiles, tannery, plastics and furniture as well as agricultural implements. Others are food and beverage, dairy products, vegetable oil and so on. The federal government also established National Truck Manufacturers (NTM) in Kano as a commercial vehicle assembly plant. Due to so many problems associated with water supply in Kano state majority of the industries resort to alternative sources of water through drilling their borehole and using machine to draw water for their smooth running rather than depending solely on the public water supply from Kano state water board which provides only 65 million liters per day instead of their total demand of about 125 million liters per day.

Water Supply and Demand in Kano

In Kano, the water board, community and individual produce water from both surface and ground water deposit. Kano state government constructed several dams across the state and utilize them for water supply to the population. Besides, many boreholes and wells were constructed for water supply by individuals and other nongovernmental organizations. Moreover, especially in typical villages individuals take water directly from nearby river, streams and ponds Kano State Water Board agency is responsible for water supply to Greater Kano and the other regional Schemes across the State. While Kano State Rural Water Supply and Sanitation Agency (RUWASA) is responsible for water provision to rural areas. The Ministry of Water Resource is the supervisory agency in terms of water supply in Kano state. It's obvious that the largest water schemes are responsible for supplying high quantity of water to the people located in greater Kano while the rest of the water treatment plants supply water to designated local government areas within their region mostly local government headquarters and large towns while the villages are left without public water supply.

The whole water treatment plants in Kano state have the design capacity of producing about 506 million litres per day. The largest and giant water work is new Tamburawa with 150 mld, followed by second and third Challawa water work each with 90 mld respectively. Then Watari have 45 mld, and then followed by the rest regional water scheme. However, Tamburawa, Watari and Challawa water work treatment plants are unable to efficiently satisfy the installation capacity designed to achieve. It's very clear that the treatment plants cannot fully utilize their raw water. Hence, they cannot supply water in accordance with their design capacity. For example; Challawa water plant which has the design capacity of supplying 200 million liters per day can hardly exceed an average of 115 million liters per day (only about 57.5%).

Also, Tamburawa which has the capacity of producing 170 liters per day in supply has only an average of 70 mld (about 41.2%) and Watari has design capacity of producing 45 mld but is able to supply only 15 mld (about 33%) only. In addition to the plants, sixteen regional water schemes are located in different parts of Kano state and they have the installation capacity of supplying about 92 million liters per day to their respective consumers but unfortunately, the combined production capacity of these regional water treatment plants is at present can hardly exceed about 70 million liters a day, serving over 100 towns in six zones. Sometimes it may even go to less than that. About 20 million litres are not realized from these sixteen regional water schemes. The water is only available in local government headquarters and other major towns and most of the villages have no pipe borne or tap water at all. Many of the people in these areas have to look for other alternative sources of water for their needs. Rural communities have been focused mainly on digging deep tube wells and installing hand-

pumps to extract groundwater, which is harmless and qualitative.

As for statewide water demand and supply, Kano state is yet to provide adequate water supply to its population. The total water demand of Kano state is 975 million liters per day (mld) and the supply is 270 mld. The difference is 705 mld. Thus the Kano state is only getting 27.7% of its daily requirements. The total water demand of Kano metropolitan presently is about 550 million liters per day but the whole water work is able to supply only 200 mld, about 36%. It's very clear that the demand is far away from the supply. This shows that the government alone cannot satisfy the demand of the public. It's also obvious that Kano metropolitan has high water demand than the rest of the Kano state. The main reason why Kano metropolitan with population of less than 3 million has demand more than the rest part of the state with population of approximately seven million is high concentration of industrial and commercial activities which consumes large quantity of water. There are about 1,140 industries and these industries directly or indirectly require water for their normal operation. Most of these industries are tanneries, food and beverage and agro alliance industries. Also commercial activities such as markets, banks and hotels needs much water. There are more than 360 commercial accounts in Kano metropolitan. In addition, the life styles of city residents differ from those living in semi-urban areas and villages. In city, an individual may take shower 2-3 times a day while villager may pass a day without showering.

As a result, private individuals like commercial water vendors and philanthropists supply water. Majority of these water vendors collect water from boreholes and sell it to public at an average rate of 20-30 NGN (0.19 USD) per 25 liters depending on the proximity to the source of water supply.*(Source: Ilyas, 2000)*

If we think about a year and make a calculation on supply and demand (inputs and outputs) of potable water demand in Kano, it is revealed that the total water input in Kano state from precipitation which stored in dams and underground water is about 7.10 billion cubic meters.

The estimated evapotranspiration of water is 4.68 billion cubic meters and about 1.21 billion cubic meters is discharged to other state downstream. Kano state retained a total of 1.21 billion cubic meters in its reservoirs. The total water demand of Kano state is 355,875 million liters in a year and the supply to the state is 98,550 million liters in a year. So, the deficit is 257,325 million liters yearly. However, the retained water in the reservoirs is 1.21 billion liters. This calculation reveals that the Kano state has enough water for its demand in the reservoirs but this water cannot be transported to the users. The problem in Kano state is the mismanagement, not unavailability.

Problems Associated With Potable Water in Kano Municipal

The provision of potable water supply to the Kano city and other local government headquarters, town and villages encounters with a lot of problems. The power problems associated with water supply for the running water treatment plants machinery in Kano is very serious. There is irregular electrical power supply from Nigerian power holding company which hampers the smooth operation of water supply system. The power supply is erratic and can hardly last for 10 hours, even though the water board has some arrangement with power Supply Company. As a result of power failure to run the machinery, pumping installation mechanism are not functioning well, this makes water board resort to use diesel as an alternative to supplement power but the cost of diesel is very high too, this drastically affect water supply in Kano state.

Exposed pipes and old age of the water tanks and other distribution facilities which mostly were in use for more than 50 years are also causing some problems. Many tanks and distribution mains are leaking due to over aging as result of its leading to the losses of water. Also, most of these pipes are undersize because they are laid several years ago when the water demand was not much as it's now and uncontrolled population growth and migration into Kano city and other urban areas increased population in time. In addition, The Kano state water board and its related agencies such as Water Resources Engineering Construction Agency (WRECA), Rural Water Supply and Sanitation Agency (RUWASSA) and the State's Ministry of Water Resources do not have full autonomy, in other words, they do not have total freedom to exercise their power in the water sector and recruitment. Also, inconsistency in government policies and political instability

cause some problems. When a new government comes it disregards previous policies and brings a new policy of its own in water resources. This is seriously dragging the water resources agency in Kano state backward in achieving its goals. Moreover, lack of enough capital to efficiently run the water sector in Kano state is a serious problem. The government budgetary allocation to water sector is not enough and the tax and monthly due paid by consumers to the board is not sufficient to cater for high electricity bill, high cost of chemical and other miscellaneous expenses in the sector. Besides, proper maintenance, inadequate skilled personnel to effectively manage the system is another problem.

Geological Constraints

Landforms and Relief

Kano is characterized by four different landform types, but in general terms about 60°o of the land surface may be classified as plains. The four Landforms, according to Olofin (1987) are: dissected hilly land, Plains with grouped hills, Alluvial channel complexes and Drift plains pediplain. These collectively make groundwater so scattered and irregular in its stability within the area surveyed, and yet make it uneasy for tapping or excavation.

The larger section of the State to the south and Northwest is under taken by rocks of the Basement complex types, with intrusions of younger granites in the extreme southern parts. The area of the Basement complex rock is separated from others by a zone recognized as the hydro-geological divide. The Basement Complex is Pre-Cambrian in origin and consists of metamorphic and igneous types. They have also been exposed to weathering, and consist of metamorphic and igneous types, thus making hydrological and hydro geological condition so unbearable.

Discussion

The main aim of this research was to find out the nature and reasons of the problems of potable water and distribution in Kano municipal. The motivation of this study is the untold suffering the communities of Kano municipal are facing because of lack or uneven distribution of portable water supply.

Several variables that influence the distribution of portable water were also taken into consideration to provide insight extent on each of the variables contributed to the problem and then possible suggestion in solving the problem(S), were drawn. From the data gathered it has been observed that people of the area are suffer immensely in looking for portable water which is attributed to the differences in the irregularities of the pipe borne supply and social status among others. This force the people to look for other alternatives which this study also conversed, especially presently the alternatives in the use and the one people like most among them to be improved by the policy makers.

Similarly from the research observed people of the study area suffer a lot with the problems of portable water distribution as a result of insufficient water supply, most of people abandon their work, refuse going to markets and other activities to look for tap water in the morning, other inhabitants woke up early to start looking for the water. The main source of tap water in the study area are those tap at home with the absence of water as a result of insufficient power supply that will help for operating the engine for the filtration of the water and the supplying. The availability of the water in the reservoir are in wet season that is when the reservoirs are fully recharged from the rain water is help in boosting the supplying of the tap water during the rainy season that is when the people have more supply of tap water, the scarcity of the water in reservoir during the dry season is another factors that is effecting the supply of the water in the study area.

But even during the rainy season the supplying of the tap water didn't meet the need of the people in the study area as a result of failure of power supply, corruption, mismanagement and non-maintenance of the equipment. The major alternative source of water that people in the study area have is to use vendors for their supplying of water the construction of boreholes is less in the study area because of it expensive in construction and maintenance, the people response to the problem is to bear the problems since the cant abundant their houses, families and other things because of the problem even so is effecting them more of financially since they are buying the water from the vendors and sometimes people have to go far some kilometers looking for vendors in search of the water. The community and government need to joint force in tackling the issue the community have to utilize the facilities provided by the government properly and the government have to put more effort in tackling the problem by providing sufficient power supply, tackle the corruption among the water board agencies,

maintenance the equipment's and provision of other alternative source of water if necessary.

Areas like Zango, Shahuchi, and Yakasai where the population is dense, have been assisted by hand pump well which is constructed by KSWB. But this type of well does not last longer in the area because of mismanagement by the people and poor maintenance by the KSWB, 8 of the respondent have suggested the KSWB to construct more boreholes and 2% have suggested the government and KSWB to subsided the rate of water.

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