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RESIDENTIAL WATER USE IN ONITSHA NORTH LOCAL GOVERNMENT AREA, ANAMBRA STATE, NIGERIA

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ABSTRACT: Meeting domestic water requirements has been a very big problem to urban planners. To evaluate the pattern of water supply and use in households in the study area, systematic random sampling technique was used to select the households that were interviewed. Survey questionnaires were employed with which data on water-use characteristics of the respondent households were obtained. A total of 250 households selected at random sampled, and the data obtained were presented in frequency distribution tables, bar charts, pie charts and graphs. The hypothesis formulated were tested using chi-square (x^2) test for the goodness of fit. The gross inefficiency in domestic water-use observed among residents in the study area requires that government and NGOs make provision for water to augment the efforts of the private sector, promote sanitation and enforce conservation if water-use is monitored.

KEYWORDS: Residential, water, Domestic, Commercial, Conservation.

1 INTRODUCTION

Water is required in almost all spheres of human activities. The uses of water can be broadly classified into residential water use and commercial water use. The use of water under both classes include direct consumption or indirectly for washing, cleaning , power generators, cooling, transportations, cooking, livestock watering or even waste disposal. The end uses of water include all places where water is used in a regular household's home such as toilets, shower, washing machines, faucets, lawn watering etc. Accurately measuring and modeling these end uses and the effectiveness of conservation efforts has been the problem of urban water planning for many years. Understanding where and when the consumer uses water is critical information for utilizing, planning and conserving water so as to ensure adequate water supply at and when due.

Effective evidence on conservation measure can be used to improve the design and supply of residential water by professionals. Residential water demand is a function of temperature, rainfall, house value; water price and household size. Household use of water is very vital. What will your day be without water? Personal alimentation such as bathing, brushing the mouth, drinking, washing dishes, and general laundry will be difficult or impossible. This means that every day, we all rely on water for a wide variety of uses within the house and outside.

According to Unites States Environmental Protection Agency (EPA), each house uses an approximate of 50gallons of water. When water is efficiently allocated in a particular residential area, the quality of life of the inhabitants of this particular area is improved as water is a basic prerequisite for sustenance of life.

1.1 STATEMENT OF THE RESEARCH PROBLEM

Virtually all urban cities in Nigeria do not have adequate water supply in their homes. Residential water supply is a determinant of the quality of life that will be expected from a particular residential area. In the case of Onitsha North L.G.A., the problem lies with irrational use of potable water for domestic use. Scarcity of water have now become the order of the

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day as people trek long distances and also pay high bills for water supply. Lack of adequate water supply for domestic purposes results to poor environmental sanitation/hygiene giving rise to spread of diseases as well as death from water borne diseases.

On the other hand, over-use of water occurs in some parts of Onitsha under the same local government. This is as a result of improper planning as well as population density within these areas. On the basis of this, the research is centered on residential water use and how water is supplied to various parts of Onitsha North local government area. Effort is also geared towards bridging the gap between over-use and under-use of water among various areas in the study area and ensures rational water supply, treatment and management of water and conservation of water resources for sustenance.

On the basis of this; the following Research Questions were raised for which answers where sought for in the research work:

1. To what extent is the water requirement of the water users in the study area satisfied?
2. Are there cases of over-use and under-use in the study area? (Imbalance in water-use among water users)
3. Is there a suitable water management plan on ground in the study area?

1.2 AIM AND OBJECTIVES

The aim of the study is to strike a balance in the water-use across users irrespective of socio-economic or geographical orientation of the residents in the study area with a view to attain sustainability in water-use for the present and future generation. To achieve this goal, the following objectives were set:

1. To determine the consumption pattern of water in Onitsha North and factors that affect water supply
2. To determine if the adoption of management mechanic based on conservation can significantly improve water supply and active sustainable water supply for the future
3. To estimate the quantity of water used per capita and make deductions based on rational and irrational use of water
4. To broaden the mind of the inhabitants of the area on water management schemes to ensure sustainable use of water

1.3 SCOPE OF THE STUDY

The study focuses on Onitsha North L.G.A. of Anambra State, Nigeria. Fourteen (14) test sites were chosen using random systematic sampling for convenience in data handling. As a result of time and financial constraints, this study is limited in scope to address pattern of water supply, pattern of consumption, factors that influence supply and consumption, management and conservation techniques geared towards water resources and creating awareness on water resources management. The scope also covers the use of water for various domestic purposes such as washing, cooking, bathing, laundry, cleaning and so on. The research considers water consumption per capita use not per purpose. Per capita involves the total amount of water that is usable in a given family unit each day. Survey questionnaires were used as primary source of data. The questionnaires were administered only to selected areas and information obtained was analyzed using frequency distribution such as bar charts, pie charts, graphs and chi-square (x^2) statistical methods.

1.4 THE STUDY AREA

Onitsha North is located in the South Eastern part of Nigeria with coordinates: 6º10'N and 6º47'E. The area of Onitsha covers:

- City: 14sq mi (36.19km^2)
- Land: 13.9sq mi (36.2km^2)
- Water: 0sq mi (0.067km^2)
- Urban: 9.8sq mi (25.45km^2)
- Metro: 14sq mi (36.19km^2)
- Time zone WAT (UTC +1)

As of 2001, Onitsha had an estimated population of 511,000 with a metropolitan population of 1,003,000. But the population of Onitsha was 561,066 as at 2006 according to GeoNames geographical databases.

The state of Lagos and various Northern towns are partially fed by supplies from Onitsha. Trade soared between the east and west of Nigeria because of the Onitsha market. This made a strategic gateway for trade between the former eastern and western regions. The major occupation in Onitsha is trading with few people mostly residing in the rural part of Onitsha engaging in fishing. The chief commercial products growing Onitsha are nuts, corns, fruits and vegetables. Other products

which form an integral part of trade in Onitsha include tires, petroleum products, nails and bearings. They are largely manufactured in and around the city. The city has a great source mineral water.

Onitsha is being located in the South eastern part of the country which is usually associated with rainy season and dry seasons. The rainy seasons runs from March-November while the dry season runs from November-February. During rainy seasons, Onitsha always experience heavy rainfalls due to its nearness to River Niger. This gives rise to flooding in coastal areas leading to destruction of lives and properties.

2 THE CONCEPT OF RESIDENTIAL WATER USE

Urban water use typically consist of residential, industrial and public uses, as well as some minor uses for other purpose such as firefighting, line cleaning and system losses. For example, in the metropolitan water district of Southern California (MWD) service area, covering about 15million people living along the Southern California coast from Oxford to San Diego, the largest sector of urban water use is residential accounting for 66% of total municipal and industrial use. Residential water can be divided into use by single-family units versus multiple family units. The types of units generally have different patterns of use for both economic and demographic reasons in multifamily units are usually not metered and billed individual, instead, there is a single bill for the entire building. Demographically, multifamily units are associated with smaller family size although the opposite may be true in lower income areas where large households may live in an apartment unit because they cannot afford to buy home of their own. Also, multifamily units may have somewhat fewer water using points than single family units. For example, residential water use in a normal quarter area is now estimated to average about 150 gallons per capita per day for single family units and 110 gallons for multiple family units generally (Urban water use in California, 1993).

Table 1 presents data on breakdown of residential water use among different end users for simple versus multi-family units in the service area

WATER USE CATEGORY	SINGLE FAMILY	MULTI FAMILY
INDOOR		
Toilets	30	30
Showers/bath	27	25
Washing clothes	21	17
Croaking leaning	13	13
Dish washing	6	4
SUBTOTAL	97	89
OUTDOOR		
Landscape	46	18
Cooling	0	1
Swimming pool, car washing	7	2
SUBTOTAL	53	21
TOTAL	150	110

Source: Urban water use characteristics in the metropolitan water district of Southern California

As an illustration during much of the 1980's, water planners in California and elsewhere generally assumed that indoor water use averaged about 77 gallons in a traditional non-conserving single home and about 60 gallons in a conserving home, based on information about water saving from conservation developed by Brown and Caldwell (1984). The Brown and Caldwell study assumed that people flush toilets at home about 4 times per person per day and low-flush toilets use 3.5 gallons per flush versus 5.5 gallons per flush for traditional toilets. It is assumed that low-flow shower heads use about 2 instead of 3.5 gallons per minute for about 4.8 minutes per person per day and conserving clothes washing machines use 42 instead of 55 gallons per load, with 0.3 loads per capita per day. Indoor residential water usage depends crucially on the types of appliances owned and how often they are used. Outdoor residential water usage depends crucially on lot size, climate and style of landscaping.

According to American water works association in a sponsored detailed study by Aqua craft, because residential water usage is not metered by appliance, it is quite complicated trace back usage to individual appliance etc. from the result of the study, Aqua craft estimated the following for the study sites

- Average per capita daily use: 171.8gdp
- Average per capita indoor use: 69.3gdp
- Average per capita leakage: 9.5gdp, concentrated in small homes
- Indoor use patterns are more stable than outdoor use patterns
- 30% reductions are achievable on indoor use with new fixtures etc.

The most important conclusion from a water supply planning standpoint is that indoor water usage reduction are achievable through the introduction of new fixtures and other water conservation measures. Outdoor usage can typically be reduced by 30-35% using available water conservation landscaping practice.

2.1 FACTORS INFLUENCING RESIDENTIAL WATER DEMAND

Historically, most of water demand literatures have focused on price because of its role as a short term and long term demand management tool.

2.2 THE ROLE OF PRICE IN DETERMINING DEMAND

As with many publicly provided goods, the price paid by individual household is not based on a series of market outcomes (example, the interaction of supply and demand) rather, the rates, as well as the rate structures themselves are often determined by the water provider. This has resulted in the use of wide variety of pricing schemes as utilities attempt to generate a stable steam of revenue while simultaneously promoting conservation and equitable allocation of water among households. Households typically pay a fixed service charge in addition to per unit cost. Within the United States, there are three predominant rate structures use to price water: the uniform, the increasing block rate and decreasing block rate. Uniform rate structure pay the same margin price for all units consumed. Households facing an increasing block rate structures face a constant price over the first units consumed, but pay a higher amount over the next units. Increasing block rate structures have become increasing popular because of their ability to promote conservation among individual water uses (Cavanagh et. al., 2002).

2.3 WEATHER

Generally, scientists agree that weather related variable may affect water demand. There are two (2) pertinent questions on the concept of weather affecting water demand

- Which of the weather related variables do consumers actually respond to (example, temperature, versus precipitation)
- Do households respond to changes in weather as continuous events or based on predetermined threshold, i.e. do households respond to the amount it rains or simply that it rained.

Effective precipitation has been used to reflect change in the quantity of water needed for outdoor irrigation purposes. The result for Texas illustrates that water use rises when temperature reaches about 70ºF and then arises sharper at 90ºF. This indicates climate affects water use due to rise and fall in weather elements. In the tropics - the non-arid zones, during rainy seasons, people in those areas collect water from the rain water thereby decreasing the demand for municipal water supply.

2.4 SIZE OF THE HOUSE AND THE LOT

It is frequently hypothesized that house size and lot size are positively correlated with indoor and outdoor water demand respectively. Much of the available research however struggles to establish statistical significance among these intuitive relationships. Cavanagh et. al, (2002), for example found that every 1,000 square feet of house size in 11 urban areas in the U.S. and Canada, 39 increased water demand by 13-15%. Also, they found each bathroom increases demand by 6% and also that the number of bathrooms significantly and positively correlated with water demand. A somewhat clearer picture exists regarding lot size. Arbues et. al., (2001) found that water use is less proportional to the increase in household size or population because of economics of scale in discretionary and non-discretionary water usage, including cooking, cleaning, car washing and gardening.

3 RESEARCH METHODOLOGY

3.1 SAMPLING METHOD AND QUESTIONNAIRE ADMINISTRATION

Sampling the whole Onitsha North will not be cost and time effective. In view of this, random systematic sampling was used to select 14 test sites which act as representatives of the entire streets in Onitsha North. A total of 250 questionnaires were administered directly on 250 households for seven days.

DATA INTERPRETATION AND ANALYSIS

Data collected were analyzed. Based on the 250 households sampled, the findings are shown below;

Table 2: Distribution of Respondents by location

S/N	LOCATION	FREQUENCY	PERCENTAGE (%)
1.	Kano street	16	6.4
2.	Nwokedi street	10	4.0
3.	Affar street	19	7.6
4.	Venn Road South	21	8.4
5.	Emejulu street	18	7.2
6.	Benjamin street	20	8.0
7.	Obi street	18	7.2
8.	New American street	16	6.4
9.	Anazonwu street	19	7.6
10.	Old cemetery road	17	6.8
11.	Ozomagama street	21	8.4
12.	Anionwu street	16	6.4
13.	Obanye street	19	7.6
14.	Ezenwa street	20	8.0
TOTAL		250	100

Source: Field survey

Table 3: Distribution of respondents by housing type

S/N	HOUSING TYPE	FREQUENCY	PERCENTAGE (%)
1.	Bungalow	60	24
2.	Self-contained flats	107	42.8
3.	Duplex	7	2.8
4.	One-room apartment	76	30.4
TOTAL		250	100

Source: Field survey

Table 4: Distribution of respondents by access to public water supply

S/N	ACCESS TO PUBLIC WATER	FREQUENCY	PERCENTAGE (%)
1.	Yes	55	22
2.	No	195	78
TOTAL		250	100

Source: Field survey

Table 5: Distribution of respondents by source of water supply

S/N	SOURCES OF WATER SUPPLY	FREQUENCY	PERCENTAGE (%)
1.	Boreholes	195	78
2.	Tap water	25	10
3.	Well	17	6.8
4.	Others	13	5.2
TOTAL		250	100

Source: Field survey

Table 6: Distribution of respondents by adequacy of water supply

ADEQUACY OF WATER SUPPLY	FREQUENCY	PERCENTAGE (%)
Adequate	37	14.8
Inadequate	213	85
TOTAL	250	100

Source: Field survey

Table 7: Distribution of respondents according to water supply per household per day

EXISTING WATER PER HOUSEHOLD PER DAY	FREQUENCY	PERCENTAGE (%)
100 Litres	8	3.2
200 Litres	39	15.6
400 Litres	86	34.4
>400 Litres	93	37.2
Others	24	9.6
TOTAL	250	100

Source: Field survey

Table 8: Distribution of respondents according to how often water is supplied

DELIVERY TIME	FREQUENCY	PERCENTAGE (%)
Daily	78	31
Weekly	63	25.2
Monthly	30	12
Yearly	0	0
Any time it finishes	79	32
TOTAL	250	100

Source: Field survey

4 DISCUSSION OF FINDINGS

The results show that there is scarcity of water for domestic consumptions in Onitsha North as compared to World Health Organization (WHO) standard specifications for household water use which stands at 150mg/l per person per day. The Unites States environmental protection agency standard for water use per person per day is 150-170mg/l. These standards were met only about 10% of the sampled population, the remaining 90% does not meet these standards. About 32% of the sampled population can be said to be in excess supply of water, an unacceptable attitude as it affects conservation of fresh water resources, whereas the remaining 68% are in short supply; this result in the case of overuse and underuse in the area. There is also problem of overexploitation of fresh water resources through the drilling of many boreholes leading to increase in extraction of ground water more than the rate of recharge. Individuals that are of high income status usually indulge in this in their homes and pump water at will. This forms about 45.6% of the sampled population leading to overuse of water resources by these people. The low income earners forming about 54.4% of the sampled population who cannot drill boreholes bears the pain of underuse, lack of funds for efficient functioning of water management services. These problems can be traced to:

Delivery system or accessibility: access to water supply contributes greatly to the quantity of water put into use in the residents sampled. Some people trek considerable distance from their homes to their source of water supply. This affects the quantity of water they can fetch per day, which will not necessarily be up to stipulated standard.

Water tariff: the price at which individuals purchase water or pay for water services also determine the quantity of water that will be made available to them. The price of water usually varies especially with the weather conditions. This is because, during the dry season, there is increase in the price of water which will consequently lead to scarcity of water. Water points are not metered, as a result of this, individuals use water carelessly because they are not billed. Most of the water points used in Onitsha are not modern. They are old water points that use low pressure to pump water for various purposes. Lack of education and awareness on the part of the inhabitants on the need to manage and conserve fresh water resources also leads to over exploitation and overuse of water. Increase in population of the urban centers leads to overstretching of urban services which include water supply. Overstretching of these facilities leads to shortages and scarcity.

These findings have its implications both on the dwellers and on the environment. Disease epidemics loom in view of this as adequate water supply or domestic water use is directly related to the regression of water borne diseases, lack of water for personal and domestic hygiene, lack of portable water for drinking. Inadequacy of potable water supply leads to dependency on contaminated water which may lead to water-washed, water-based and water-borne diseases. The total effect of these tells on the sanity of the environment making it less attractive. Increased extraction of water leads to overdraft and draught. Since mankind depend only on less than 3% of the total water (fresh water) for his sustenance, depletion of this resources will lead to several environmental impacts such as: scarcity of water, eutrophication of fresh water, loss of aquatic lives, reduction or halt in human activities, halt in developmental activities, loss of harmony between man and the environment.

5 RECOMMENDATIONS

On the basis of these findings, the following recommendations are made:

1. There should be adequate provision of water services by the government to ensure adequacy of water
2. Water services should be properly planned and managed for efficient allocation
3. Water used by the domestic sector should be monitored and metered especially those operating private boreholes to ensure rational use
4. Influx of population in the urban areas should be checked to avoid overstretching of urban services
5. Conservation programme should be conducted towards water management to broaden the mind of the inhabitants on proper water management and conservation

6 CONCLUSION

Water use for domestic purposes constitutes over half of the total water use. Inadequacy of water for consumption in Onitsha North as revealed by the result is an indication of poor planning and inefficient allocation of water services in the area. As a result of this, individuals take up the task of providing water for efficient functioning of domestic activities. This leads to deterioration of both water resources and the environment. Price, accessibility and demographic factors greatly alter availability of water for domestic purposes. Scarcity of water leads to spread of diseases, both water borne and otherwise. Government should gear effort towards providing adequate water supply services in Onitsha North, Anambra State.

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