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# Prospect of Urban Water Supply in Jalingo Metropolis, Taraba State Nigeria

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**Abstract:** Urban water supply have been one of the major challenges facing residents of Jalingo Metropolis over the years. Taraba State Government in partnership with the African Development Bank (AfDB) has recently embarked on massive investment in urban water supply in Jalingo Metropolis. The project is aimed at providing water to the citizenry and galvanizing commercial activities in the State. This study examines the various water resource potentials available to the town and the prospect of harnessing these resources and the challenges associated with each of the options. The study relied substantially on existing data sources, fieldwork and discussion with experts and consultants working on the projects. The collected data and information were analyzed using descriptive statistics. The findings of the study shows that the existing Jalingo Water Supply System relied on open well field consisting of 14 boreholes out of which 4 boreholes are currently operational and 10 are non operational. The findings shows that the water supply to Jalingo town does not have any form of treatment and no provision is made at the moment to disinfect the borehole water which is distributed to the public at the moment. Storm water runoff from Jalingo township discharges into the borehole field (Jalingo Master Plan, 2000) thereby constituting potential hazard as aquifers are susceptible to contamination particularly during the rainy season. At the moment only 30% of the Jalingo town's water requirements are met. The findings of the study shows that the water resource options in Jalingo Metropolis include the abstraction of ground water through drilling of boreholes, construction of infiltration gallery and construction of dam across River Lamurde. Although, urban water supply prospect in the town is high, none of the options can generate sufficient amount of water supply to the town in the nearest future. This study therefore recommends the need to consider the development of all these water resource options in the study area to complement each other.

**Keywords:** Jalingo; Lamurde; Prospect; Taraba state; Urban water supply.

## 1. Introduction

Urban water supply have been one of the major challenges facing residents of Jalingo Metropolis over the years. The town has witnessed unprecedented population increase in recent times owing to a number of factors. The town has enjoyed relative peace over these years. The relative peace has led to influx of people into the town. Thus, the town has grown from a city of less than 20,000 people in 1963 (Oyedele, 2012) to 140,000 during the 2006 National population census. The population today is estimated to be 180,000. This has placed heavy demand and pressure on available social amenities, water inclusive.

The existing water supply system and distribution network in Jalingo town before now using groundwater source was the initially installed capacity of 6,500m$^3$ per day. It was later reduced to about 2,735 m$^3$ per day owing to ageing of facilities and lack of maintenance (Musa, 2002). The present water supply obviously can no longer cope with the present water demand of about 22,466m$^3$ per day. According to Musa (2002) about 8.2million m$^3$ of water is required per year to meet the present water demand, which is expected to increase to about 19.3million m$^3$ per year at the end of the next decade to cater for an estimated population of 225,393 people. Presently, survey shows that 20 litres of water sells at N20.00 (UDS 0.04 exchange rate as at October 2016) or more in most parts of Jalingo town. The proportion of total water requirement obtained from private supply by business firms in town is between 60 to 70%. In the peripheral rural communities, the situation is pathetic as most of the supply is either from hand dug wells, or from streams whose quality is doubtful. In most of these peripheral rural communities, many man-days are wasted each year in looking for water and hauling it over long distance.

Taraba State Government in partnership with the African Development Bank (AfDB) has recently embarked on massive investment in urban water supply in Jalingo Metropolis. The project is aimed at providing water to the

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citizenry and galvanizing commercial activities in the State. The project would increase water supply in Jalingo by about 1,200$m^3$ per hour which is equivalent to 26 million litres per day. The State government and its partners are targeting improvement of water from 4,900$m^3$ to 28,000$m^3$ per day which is expected to increase to 47,273$m^3$ per day by 2035. The present expansion in the transmission and distribution network is meant to cover every part of Jalingo Metropolis and beyond. There is a capacity to extend the water supply services to the undeveloped parts of the Metropolis.

This study examines the various water resource potentials available to the town and the prospect of harnessing these resources and the challenges associated with each of the options. The study also appraises the urban water supply situation in the town since the state creation in 1991 and presently as well as in the next two decades. This will help the state government and its development partners in drawing effective policy framework that will enhance maximum harnessing of the water resources in the area with little or minimal impact on the physical environment.

## 2. Description of Study Area

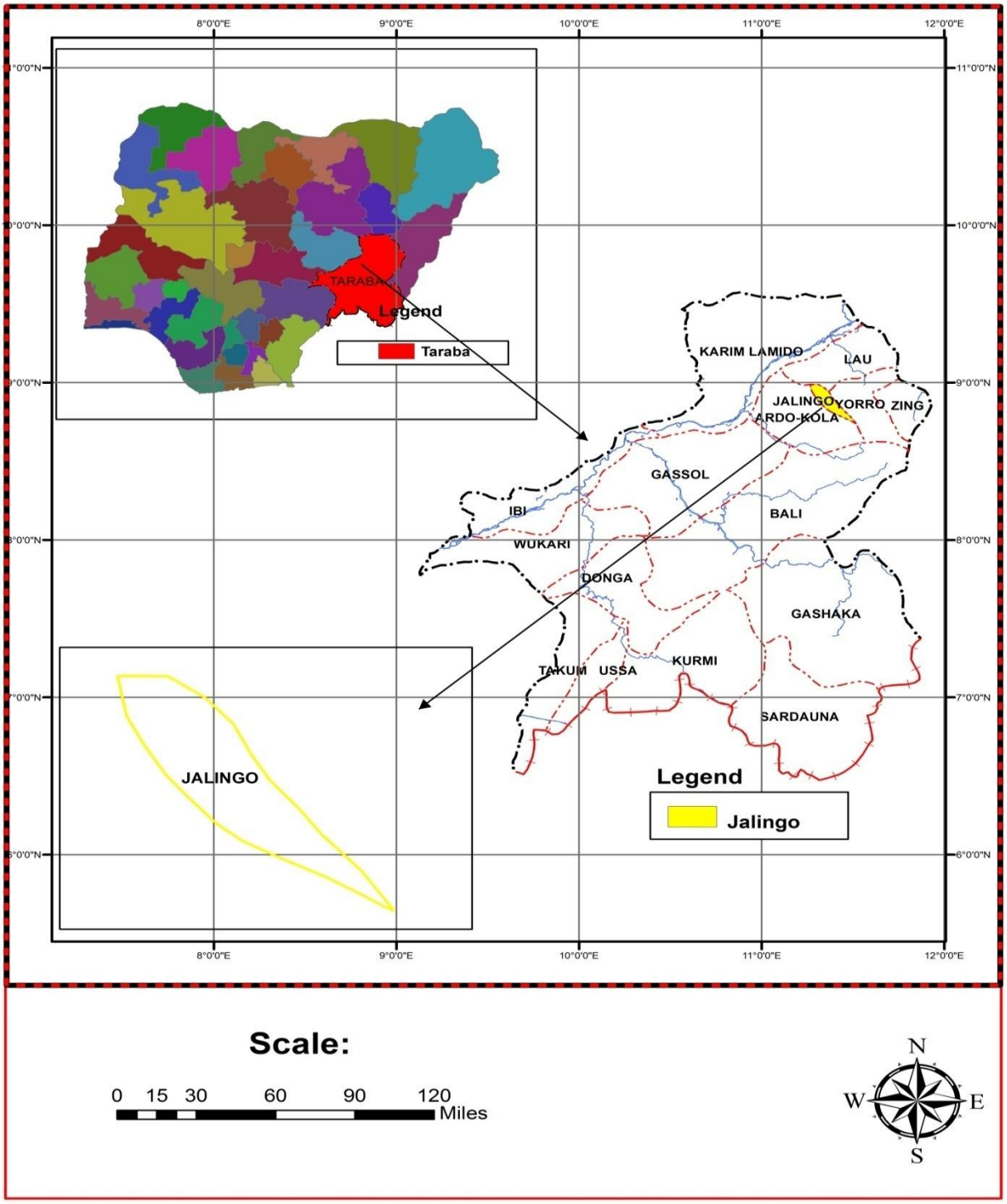
Jalingo LGA is roughly located between latitudes 8o47' to 9o01'N and longitudes 11$^o$09' to 11$^o$30'E. It is bounded to the North by Lau Local Government Area, to the East by Yorro Local Government Area, to the South and West by Ardo Kola Local Government Area. Jalingo town was founded in 1893, as a convenient and suitable site for the relocation of the administrative capital of the Muri emirate. The town developed as a war camp established eight miles south of Kona village (Oruonye, 2014). It was a military base for the operation of the Emir of Muri. Hamman (2007) observed that since its establishment in 1895, Jalingo has continued to witness phenomenal growth as a result of its being the seat of the new Muri Emirate government and a trading centre. Following the creation of Taraba State in 1991, it was made the state capital. It has a total land area of about 195$km^2$. Jalingo LGA has a population of 139,845 people according to the 2006 population census, with a projected growth rate of 3% (Shawulu *et al.*, 2008).

Jalingo town lies on gently sloping land that leads to the great Muri plains. The town lies between 305m to 610m above sea level. The ground level rises to a peak of about 914 meters above sea level in the south-east (Jalingo Town Master Plan, 2000). The Lamurde River and its tributaries drain the town into the Benue River forming watershed from this peak. There are a number of hills and rock outcrops as high as 323meters in the northern part of the town. Some of these hills include the Jauro Shadi Hill, Jalingo Hill, Jauro Ashe Hill, Hosere Waligo and Danbature Hills. The topographical characteristics of Jalingo are well suited for effective storm water drainage. The southern part of the town slopes southward and drains into River Lamurde. The northern part of the town drains into River Mayogwoi, the tributary to River Lamurde and are intersected by many other natural drainage water courses. The Jalingo hill is an important feature in the town and influences the surface run-off and storm water discharge carried by the drainage system within the areas around the hill (Jalingo Town Master Plan, 2000).

## 3. Materials and Methods

The study relied substantially on existing data sources, fieldwork and discussion with experts and consultants working on the projects. Many documents were consulted which include textbooks, articles and maps, journals (online and printed), internet, Newspapers, photograph and baseline reports, memos of Ministries, Departments and agencies, consultants, individuals and organizations. Other literatures reviewed include the Project Appraisal Document (PAD), the general environmental management conditions for construction contracts, engineering and technical designs. These documents reviewed provide comprehensive, relevant and reliable picture of the urban water supply sources, challenges and prospects in the study area. Officials of Taraba State Water Supply Agency (TSWSA) and staff of the constructing firms were interviewed on the ongoing water project and water supply situation in the town. This discussion with experts, consultants and officials of water supply agency provide us the opportunity to confirm or explain information from literatures used in the study. The discussion also gives clue about relevant information in cases where some information in the literatures used were lacking or missing. Fieldwork was carried out to verify and compliment the information gathered from the reviewed documents and discussion with stakeholder. The collected data and information were analyzed using descriptive statistics.

**Fig-1.** Map of the study area




# 4. Result of Findings

## 4.1. Existing Socio-economic Condition of Water Supply in Jalingo Metropolis

The existing Jalingo Water Supply System consists of open well field consisting of 14 boreholes of which 4 boreholes are currently operational and 10 are non operational. The water supply depends on electrical power from PHCN but this is erratic in view of the poor power supply to the state in general and hence power supply for water supply operations is mainly from diesel generating sets. The Waterworks is equipped with 3 Nos Rolls Royce model 450KVA generating sets but all are broken down (Jalingo Town Master Plan, 2000). The breakdown of the generating sets limits the number of boreholes that can be powered simultaneously and hence the quantity of water that is pumped to consumers. The scarcity and high cost of diesel used in powering the functioning generating set also inhibits the production capacity of the Taraba State Water Supply Agency (TSWSA). There is also the imminent danger of total collapse of the only functioning generating set. The water supply to Jalingo town does not have any form of treatment and no provision is made at the moment to disinfect the borehole water which is distributed to the public. Storm water runoff from Jalingo township discharges into the borehole field (Jalingo Town Master Plan,

2000). This constitutes potential hazard as aquifers are susceptible to contamination particularly during the rainy season.

The ground water is pumped through a 4km long 450mm diameter ductile iron pipe to a 500m$^3$ capacity overhead tank located near the Bureau for Land and Survey. There is 500m$^3$ capacity underground tank at the foot of mount Jalingo which is presently not in use. The existing distribution system which ranges from 200mm to 75mm A/C pipes is about 25.25km total. The existing water supply is faced with a lot of problems which include hydraulic and hydrogeologic, power supply and electro mechanical.

The imbalance in the pumping rate of the borehole pumps and the recharge capacity causes burnt out of borehole pumps until the outflow (pumping rate) equal or less than the inflow rate. This problem is as a result of improper study of aquifer capacity and the consequent improper pump selection (Jalingo Town Master Plan, 2000). The practice of random replacement of pumps that are burnt out with any available pump without consideration of the appropriate head-flow characteristics is a major factor in contributing to such imbalance. The unsuitability of pump type in comparison to the discharge and pressure head has also contributed to the non optimal performance of the water system.

Considering the increasing population of Jalingo town it has become necessary to expand the distribution system to cover additional areas such as Mayogwoi, Magami, NTA village, SabonGari, SabonLayi, Mile 6, Nukkai, University, College of Agriculture, Mayo Dasa and Garin Mallum among others. Also the existing elevated tank capacity is inadequate and would need to be increased. The above expansion will require laying transmission line from the existing 450mm diameter ductile iron pipe to the ground tank at the foot of Jalingo Hill to improve the distribution coverage. There is need to install an elevated tank on Jalingo Hills to serve the G.R.A. and its immediate surroundings that are not served at the moment due to inadequate pressure (Jalingo Town Master Plan, 2000). At the moment only 30% of the Jalingo town's water requirements are met. There are about 20,000 registered water vendors pushing water truck in Jalingo Metropolis who relied on water from private commercial boreholes, wells and streams. Oftentimes, the water from the boreholes is inadequate to meet the demands, thereby forcing the water vendors to resort to stream water.

## 4.2. Projected Water Demand in the area

The projected water demand estimates of the town are based on population growth and urban development projections as well as on the water pressure and storage volume required to ensure routine operation of the distribution network. The growth of the present resident population in Jalingo town and environs is affected by economic growth as State capital, in addition to the natural growth rate. People are migrating into the area due to crisis caused by Boko Haram insurgency in the North east region. The forecasts are based on assumed growth rates which vary for each 5 year period. The population growth in the next 20 years is estimated and presented in Table 1.

**Table-1.** Population projection in the study area

| YEAR | PROJECTED POPULATION |
|---|---|
| 2015 | 227, 406 |
| 2020 | 266, 841 |
| 2025 | 322, 268 |
| 2030 | 367, 411 |
| 2035 | 429,548 |

**Source:** TSWSA, 2016.

These population estimates is used for computing the potable water requirements for Jalingo and the benefits derived from domestic water supply. In assessing the total water demand, it is necessary to establish a reasonable water consumption rate in the light of future development. Water demand as used in this study includes personal household use and public use in hotels, schools and offices as well as industrial and municipal uses. An assessment of water consumption per capita in successive phases of development may be predicted for future planning as indicated in Table 2.

**Table-2.** Present and Projected Water Consumption

| S/No. | Projected Phases | Ltrs/capita/day |
|---|---|---|
| 1 | Present water use for drinking, cooking and washing | 24,160 |
| 2 | Water use in 2025 | 35,449 |
| 3 | Water use in 2035 | 47,273 |

**Sources:** TSWSA, 2016.

A baseline survey by CATECH Consultants reveals that the existing boreholes in Jalingo at the time of the state creation if pumped for 24hours each day and improved at 85 percent efficiency, could provide 93m$^3$ per day (assuming 20 percent system loss). This was projected by the team to maximum anticipated demand of 5,920m$^3$ per day by the year 2015 (including non-domestic consumption) (Jalingo Town Master Plan, 2000). The survey concludes the urgent need to explore alternative sources to meet future water needs of the town.

## 4.3. Water Storage Facilities

Before now, the capacity of the existing urban water storage facilities was inadequate and could at best contain less than 30% of the average daily demand in the town. To meet the urban water supply improvement drive of the Taraba State Government, more water storage structures with large capacity are presently been constructed. These water storage structures of 16,750$m^3$ capacity amount to 35% of the average daily demand of 47,756$m^3$.

The new Jalingo urban water development project takes advantage of the hills around Jalingo town for the location of water reservoir tanks. This greatly reduced the cost of erecting towers for the tanks.

## 4.4. Prospects of Urban Water Supply in Jalingo Metropolis

Urban water supply development in Jalingo Metropolis has been constrained over the years by the physical environment among other factors. The town is located in an area underlain by basement complex. Basement complex region are known for poor aquifer development which constrain ground water development. The town also lies in the tropical continental climate area characterized by well-marked wet and dry season. This affects the water availability in the River Lamurde that drains the area. With increasing population in the town, it becomes imperative to explore the available water resource options in the area so as to meet the increasing water demand now and in the future. The water source options available to the town are discussed below;

## Option 1: Drilling of Boreholes

The adoption of this option will imply the dependence on water abstracted from boreholes at the existing Magami well field, the Karofi and Specialist Hospital well fields. The water from these boreholes will be disinfected with chlorine and lifted to reservoirs from where it is distributed to consumers. About 40 boreholes will be drilled with water yield of 27,054$m^3$ in the first phase and 32,465$m^3$ in the second phase as shown in Table 3.

**Table-3.** Borehole well fields and well yields

| Well Field Locations | No. of Boreholes | Well Yield in first phase (2025) ($m^3$/day) | Well Yield in first phase (2034) ($m^3$/day) |
|---|---|---|---|
| Magami | 15 | 17,550 | 21,060 |
| Specialist Hospital | 17 | 6,480 | 7,776 |
| Karofi | 8 | 3,024 | 3,629 |
| Total | 40 | 27,054 | 32,465 |

**Source:** Adapted from Enviplan (2014)

This water supply project design based on 40 boreholes with total yield of 32,465$m^3$/day will only meet 68.8% of the year 2034 water demand (Enviplan, 2014).

Given the increasing rate of population growth and water demand in the town, the above quantity cannot meet the daily average water demand of the populace. An envisaged water project improvement design estimated the daily future water demands of 28,538$m^3$day and 47,273$m^3$day for the years 2025 and 2035 respectively. This will require increasing the number of boreholes from 40 to 54boreholes with corresponding increase in total yields to 40,317$m^3$day and 47,756$m^3$day for the years 2025 and 2034 respectively as shown in Table 4.

**Table-4.** Borehole well fields and well yields

| Well Field Locations | No. of Boreholes | Well Yield in first phase (2025) ($m^3$/day) | Well Yield in first phase (2034) ($m^3$/day) |
|---|---|---|---|
| Magami | 19 | 22,950 | 27,540 |
| Specialist Hospital | 23 | 9,072 | 10,885 |
| Karofi | 20 | 8,295 | 9,331 |
| Total | 62 | 40,317 | 47,756 |

**Source:** Adapted from Enviplan (2014)

## Option 2: Construction of dam

The other source of primary water supply in the area is the damming of River Lamurde. This will involve construction of dyke (dam) across River Lamurde and impoundment of surface water that will be pumped to the treatment plant. This has been attempted in the past but it failed. The construction of the required infrastructure for this source of primary water would be too expensive. The area of the reservoir that will be created by the impoundment would result in displacement of settlements and human population which is not environmentally friendly. The seasonality of rainfall and the river regime in the area constitute a serious constraint to the sustainability of the project. The adoption of this option will result in inundation of large expanse of arable land, destruction of ecological habitat, loss of biodiversity and disruption of the socio-economic life of the people in the area.

## Option 3: – Abstraction of Underground Water Through Infiltration Gallery

Jalingo town is drained by River Lamurde and its tributary, River Mayogwoi. River Lamurde has 4m depth of sand deposit. So when it seems as if there is no water flowing on the surface of the riverbed, beneath the surface, water flows and drains into River Benue. This alternative involves the construction of infiltration gallery along River Lamurde (the river draining through the town), a barrier, raw water pumping station and raw water supply transmission pipeline. The project will involve excavation of sand on the floor of the river valley, construction of barrier and infiltration channel underground to abstract the water. The transmission pipeline will be reasonably straight. The problem with this is that it will be crossing road. However, since the pipeline is underground, there will be little disturbance to the environment. The urban water supply requirement will be met through abstraction of underground water which has low impact on the hydrological cycle and the environment. This is the chosen alternative which will sustain increased raw water supply to the urban water supply scheme in the area.

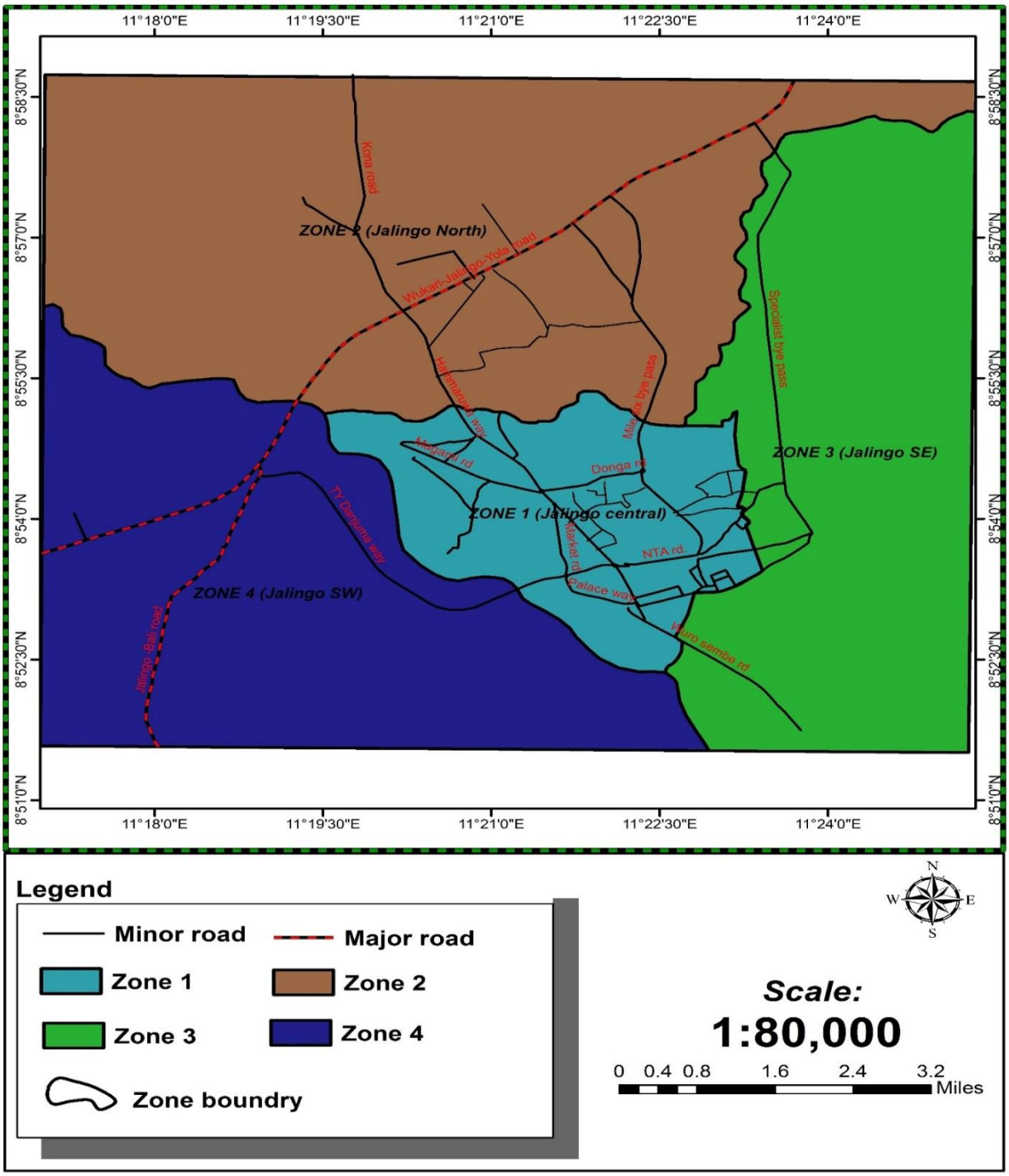
The implementation of this alternative will not entail displacement and off course resettlement of any community along the upstream /downstream stretch of River Lamurde. Consequently, there will be no submergence of any existing public infrastructures in the communities and its environs. This project option will financially cost less than the dam option. However, it will result in minimal disruption of economic activities along the river bank where the project is sited, but alternative sites can be provided for the displaced activities.

The Lamurde River provides the most cost effective and reliable water supply source for augmenting and expanding the long-term raw water supply to Jalingo town. There is considerable scope for optimizing use of this water. Several options will be developed as part of the project. These include rainwater harvesting, recycling of wastewater, storage of wet season river flow, rehabilitation of catchments, groundwater monitoring and licensing, artificial recharge of groundwater, reduction of water losses in irrigation and water supply, and pollution control.

Aside from the ongoing AfDB funded Jalingo Urban water supply and sanitation there is also the Taraba state government funded Jalingo Primary water supply project being executed by SCC Nigeria limited whose major components include the construction of the following;

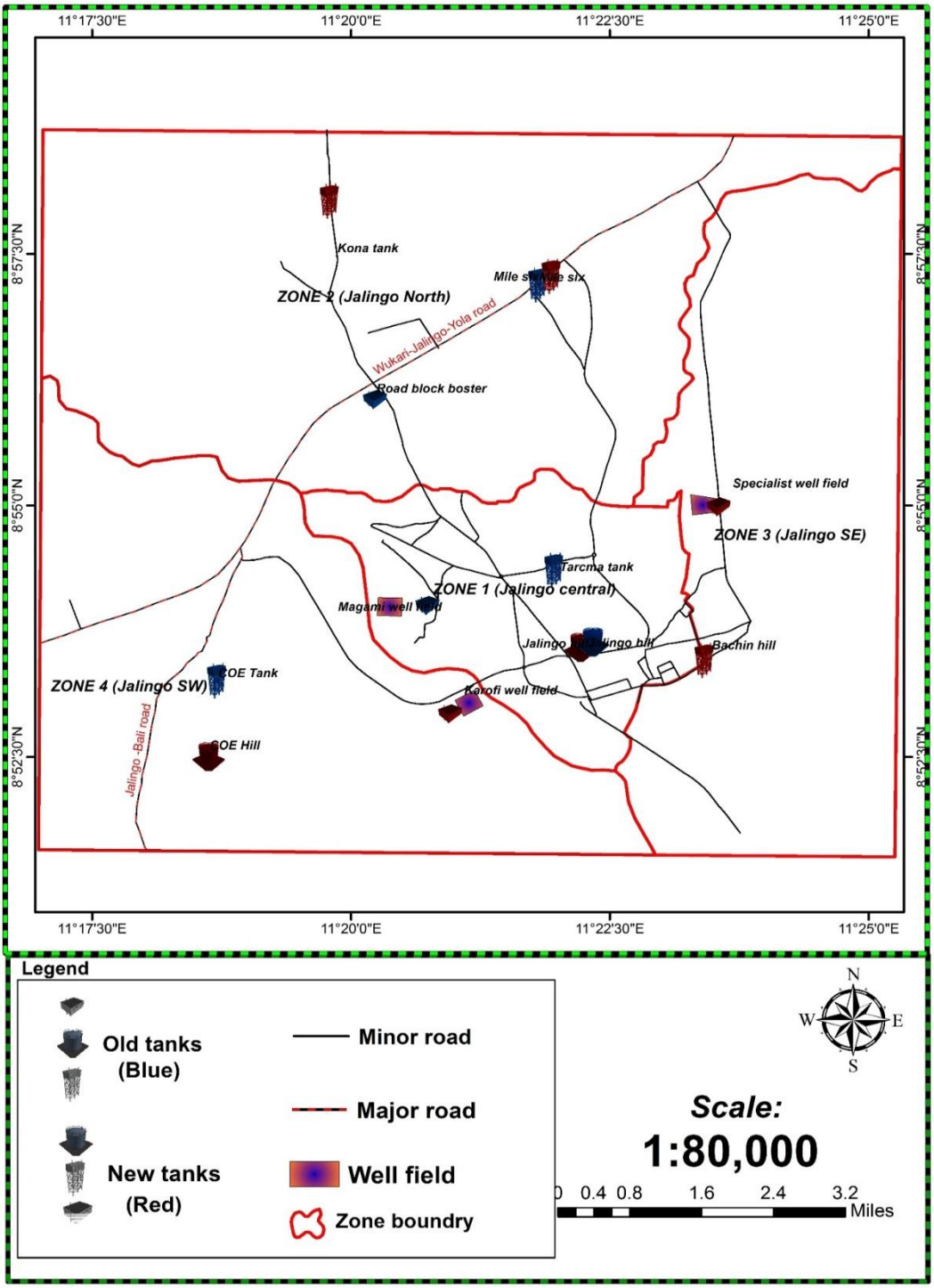
i. Infiltration gallery
ii. Raw Water supply system
iii. Treated water supply system.
iv. 3km length of rising mains.
v. Additional distribution network

**Fig-2.** Map of Jalingo Town showing four Urban Water Supply Zones.




**Source:** Ibadin (2016)

**Fig-3.** Map of Jalingo Town Showing Distribution of Water Storage Structures




**Source:** Ibadin (2016)

vi. Additional 5000m$^3$ reservoir tank on central Jalingo hill.

**Table-5.** Companies Handling Urban Water Project in the Study Area

| S/No | Name of Company | Project been handled |
|---|---|---|
| 1 | CGC Nigeria Limited | Construction of Transmission Mains |
| 2 | China Zhonghao | Construction of Distribution Mains |
| 3 | APEXHIEGT | Construction of Borehole Water Source |
| 4 | GASALAZ | Fencing Works |
| 5 | New Imagination | Construction of VIP latrines |

**Source:** The Taraba State Water Supply Agency (TSWSA) 2016.

## 5. Conclusion

This study has examined the prospect of urban water supply in Jalingo Metropolis. The study also examines all the water resource options available to the town and the challenges associated with the development of each of these options. The study finding show that the town depend on only 4 functional boreholes out of the 14 boreholes used for urban water supply in the area. Thus, only 30% of the town's water requirements are met at the moment. This is further made worse by the lack of provision to disinfect the borehole water. The discharge of storm water into the borehole field constitute potential hazard as aquifers are susceptible to contamination particularly during the rainy season. The study argues that the town has good prospect of urban water supply in the nearest future. Based on the findings, this study recommends the need to consider the development of all the water resource options in the study area to complement each other and ensure sustainable urban water supply in the study area.

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