

# Urban Growth and the Challenge of Water Security: A Case Study of Iwo, Osun State, Nigeria

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## Research Article

**Received:** 24-Jun-2022, Manuscript No. JEAES-22-64571; **Editor assigned:** 28-Jun-2022, Pre QC No. JEAES-22-64571 (PQ); **Reviewed:** 12-Jul-2022, QC No. JEAES-22-64571; **Revised:** 19-Jul-2022, Manuscript No. JEAES-22-64571 (A); **Published:** 26-Jul 2022, DOI:10.4172/23477830.10.05.002

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**Keywords:** Household Water; Water Accessibility; Urban growth; Urbanization; Sustainability; Nigeria

## ABSTRACT

The unabated growth in the population of Iwo results in rapid physical expansion of the town and so, undue pressure on the available water resources. Thus, an investigation into what the nearest future holds for Iwo town with regards to water security as a result of increasing growth in the population and the implied expansion. Data for this study were both primary and secondary. The report showed that the current trend in the expansion will have implied consequences on the water need of the town. The only source of clean water is Aiba Water Reservoir which is almost becoming abandoned for inadequate funding and other related challenges, thus performing below expectation. The rain is seasonal and the surface water resources are heavily contaminated while ground water yields are very poor and season-dependent. Thus, stakeholders in water sector works to ensure that the Water Works is overhauled for better performance.

## INTRODUCTION

The continuous expansion and growth of any human settlement often attributed to increase in population will definitely imply pressure on the preexisting infrastructural facilities <sup>[1,2]</sup>. Apart from this, increasing quests for industrial development and food production for the teeming population will further exacerbate further influence on the urbanization process. However, with the physical expansion which results from population explosion and or industrial development in any region, so also the challenge of infrastructural facilities especially water provision, become a serious challenge to stakeholders, especially inhabitants of the region discovered in his study that urbanization has profound effect on water consumption as there is high rate of water consumption in his area of study. Such increase manifests in the various uses of water such as in washing, in construction works, lawn watering, backyard farming, auto wash, sanitation among others occasioned by increased urbanization and population. Similarly, <sup>[3,4]</sup> in his own submission stated that population growth with ecosystem water needs may make many places in the globe vulnerable to water crises and so suggested that many cities around the globe may have to rethink their water supply situations <sup>[5]</sup>. Padowski and Gorelick further provided <sup>[5]</sup> information on the vulnerability of large cities to water demand through their study of 70 cities with population of >750,000 selected across 39 countries globally. Their analyses considered the countries where surface water is the dominant source and alternatives such as affordable groundwater or the ability to obtain additional surface source currently do not exist. The duo discovered that 36% of the cities were vulnerable in 2010, and revealed that by 2040, additional 8% will be vulnerable. This conclusion was based on the current growth estimates and on competing agricultural needs. It is already on record that by 2050, the highest proportion of urban centres will be domicile in developing nations, especially in sub-Saharan Africa and so forecasted that several challenges will be facing urban centres such as poor or inadequacy of various infrastructural facilities like electricity, water, transportation networks, loss of biodiversity, growth of slums, unemployment among others <sup>[6,7]</sup>. Even as of now, most urban centres in the developing countries are already battling with the crises of insufficient social infrastructures especially potable water supply which is partly as a result of increase in population. This scenario notwithstanding, the current experience from the global lockdown and the consequent protocol to combat the continuous spread of the novel COVID-19 disease may compound the problem already projected especially, access to quality water in African cities <sup>[8]</sup>. Today, many homes still face inadequate supply of quality water for their home use or even lack of it, left out the need to provide clean water for hand washing to mitigate the rise in the spread of COVID-19 disease. Thus there is urgent need for various stakeholders in water supply sub-sector to rise to the challenge of possible pandemic in water supply infrastructure to avert the grievous consequence of the impending crisis. Though some African countries have made frantic effort towards ensuring accessibility to quality water supply, poor infrastructure maintenance, challenges such as water supply politicization high level poverty and so on still hinder the sustenance of their efforts <sup>[9-14]</sup>. Jacobsen, et al. had lamented that with the rate at which African cities are growing in relation to their water management systems, it will be difficult to keep up with the growing water demand <sup>[9]</sup> the activities of State Water Boards (SWBs) and State Water Agencies (SWAs) have been grossly limited in view of the following challenges: Increased urban expansion, Poor attitude of the government towards water resource development which shows down the pace of investment in that sector, Government policies that hinder the execution of water projects; and also Fiscal constraints that hinder cost recovery in the sector. One of the challenges that hinder

and/or limit the effectiveness of SWAs in discharging its duties properly is the increase in the physical expansion of cities in each state. Expansion and migration of people, at times, in search of white collar jobs in either pre-existing and/or newly established institutions (private or public) contribute immensely to this challenge. Though, SWAs use average expansion/urbanization rate of 3% per year, the actual rate of urbanization is much higher in many cities. In two located in Osun state in particular, the urbanization rate will be slightly higher in view of various institutions of learning which attracts people from nearby settlements and other cities either as seekers of employment, students, contractors, business men and women among others. Provision of portable water and other related responsibilities has always been vested in the state throughout the federation in Nigeria. Significant reforms in the water sector were dated back to 1997 when State Water Boards (SWBs) and State Water Agencies (SWAs) was first established. Being a shared public sector responsibility, government at Federal, State, and Local Government levels are all stakeholders and so have their responsibilities in Water Supply and Sanitation (WSS) services. Since the time of reformation in 1977, Federal Ministry of Water Resources is responsible for policy advice to States, data collection and monitoring and coordination of water resources development, of which water supply is a component, at the national level. At the State level, SWAs or SWBs are responsible for urban, semi-urban, rural water supplies. The states through its Board or Agency provides relevant and basic information on all their current and proposed water projects while at the same time provides technical support to Local Government Authorities (LGAs) in planning, design, and supervision of their own water supply activities. Each of the LGAs in the federation is charged with the provision of portable water to rural communities within their area of jurisdiction. Generally, LGAs have not been up to the task in their area of responsibilities majorly due to shortage of professional staff and inadequate fund. However, LGA administration keep records of their water supply activities, especially, operations and making the information available to state supervisory unit as requested. It was reported that water supply coverage throughout the federation between 2011 and 2013 varies grossly and at declining rate. For instance, direct supply was 42% in 2011, 40% in 2012, but fell to 29% in 2013 (Table 1).

**Table 1.** Water supply in Nigeria between 2011 and 2013.

S/N	lnet indicators	2011	2012	2013
1.	Coverage	42%	41%	40%
2.	Coverage with direct supply	28%	28%	27%
3.	Coverage with stand pipes, kiosks, etc.	14%	13%	13%
4.	Residential Consumption	70%	66%	69%
5.	Hours of Operation/day (average)	4.57	7.3	10.

Apart from this, population/households covered with direct supply were 28% in 2011 and 2012 but fell to 27% in 2013. The population connected with stand pipes and other points fell from 14%, (1a) 2011 to 13% in both 2012 and 2013 while the residential consumption fell from 70% in 2011 to 66.9% in 2012 but rose to 69% in 2013. The average number of hours of operation per day rose to 7.3 hrs./day 2012 from 4.57 hrs./day and also increased to 10 hrs./day in 2013. Though, there was an increase in the number of operation hours per day in the period, this has not reflected in the coverage during the period. The increase in the operation hours in the period studied could

have been as a result of improved and/or better management which brings about discipline among the staff. This however has not reflected the quality of work to be in terms of water supply services.

In Osun state, the report as presented in Table 2 showed that the coverage between 2011 and 2013 experienced gross decline in the highlighted Utilities by International Benchmarking Network for Water and Sanitation (IBNET). Though it rose from 78% in 2011 to 86% in 2012, the decline to 37% in 2013 implied several thoughts. It indicates a total collapse in the sector and possibly an almost abandoned responsibility of the State government through its SWAs. Similar trend followed in the coverage with direct supply was 59% in 2011 but rose to 67% in 2012. The coverage fell to abysmally low percentage of 29%. Also, areas covered with standpipes remained 19% in both 2011 and 2012 but fell to 8% in 2013. In contrary, the number of hours of operation per day (average) in Osun state was on the increase throughout the 3-year period with 4.57 hrs./day, 7.3 hrs./day and 10hrs/day in 2011, 2012, and 2013 respectively (Table 2).

**Table 2.** Coverage between 2011 and 2013 experienced gross decline in the highlighted Utilities by International Benchmarking Network for Water and Sanitation.

S/N	Ibnet indicators	2011	2012	2013
1.	Coverage	78%	86%	37%
2.	Coverage with direct supply	59%	67%	29%
3.	Coverage with standpipes	19%	19%	8%
4.	Consumption total lpcd	9.16	15	22.11
5.	Residential Consumption	84%	84%	89%
6.	Hours of Operations/Day (Average)	4.57	7.3	10

The scenario of the situation of water services in Osun state reflects in what operates in Iwo in Iwo LGA in Osun state.

The only dam constructed in Iwo and charged with the responsibility with the provision of portable water is Aiba Dam which came into full operation officially on June 1, 1957, and was classified as one of the oldest dams in the South Western part of Nigeria. At its inception, Aiba Dam was approximately 1.91 billion cubic meters storage dam supplied freshwater from a catchment area of 54.39 km<sup>2</sup>. The dam is 11.58 m high, 455.2 m long, and a mean depth of 0.75 m. Aiba Dam was purposely constructed to provide portable water for the inhabitants of Iwo and its immediate suburbs <sup>[15]</sup>. The dam was built in 1957 when the population of the entire country was less than 45.1 million. Despite its age, the dam has not been fully utilized in providing portable water for the teeming population of Iwo, which continues to expand its perimeter and increase in the number of inhabitants. In fact, the water provision services of Aiba Dam water works is grossly limited to the immediate environment of the dam. Thus, large population of the entire Iwo town lacks access to water supply services from this Water Works. The poor maintenance of the dam has even manifested in various environmental problems facing its survival <sup>[15]</sup>, the challenges facing Aiba Dam are both natural namely climate change, sedimentation, senesce, and also anthropogenic which include management-related problems, urban spread, farming practice in the dam area and

refuse dump. The upgrading and proper overhauling of Aiba Dam is still bedeviled with several challenges despite its significance to the inhabitants of Iwo. Such challenges include State Government's gradual shifts from pipe-borne water to underground water exploitation, Inadequate funding of water-related projects by the state government, gross indebtedness of the government, unavailability of technical expertise, relegation of Local Government administration to a mere unit under the State government administration, corruption and misappropriation of fund among others. In the light of all these challenges, water security in this growing city is an issue that requires the attention of all stakeholders in this sector. Areas of focus include boosting economic status of the inhabitants through improved agricultural activities, access to incentives for SMEs, upgrading and overhauling of the Aiba Reservoir and expansion of its network to all nook and crannies of the town to ensure unhindered access to pipe-borne network, period maintenance of the dam. Other areas of focus could be embarking on mini water project to utilize the surface water resources like Oba River to boost water supply in the town and its suburbs. Thus it was suggested that concerted effort is required from water-related institutions and decision makers in order to provide sustainable water services to African city dwellers. Cities in Nigeria and many other less developed countries are no exception from the above discoveries. Many cities in most of these countries have witnessed immeasurable growth occasioned by government policies and actions over time. For instance, in order to decongest most big cities and also to encourage the development of other suburbs, various developmental projects are being sited in these suburbs. For instance, in order to ensure equitable distribution of educational institutions and access to tertiary education in Nigeria among other targets, Federal Government of Nigeria in 2020 and early 2021 announced the establishment of a Polytechnic in Ayede, in Ogo-Oluwa Local Government Area in Ogbomoso zone of Oyo State. Also, a newly established Federal College of Education was approved to be cited in Iwo, Osun State among other beneficiary cities. With this trend, coupled with other factors that induce people into the ancient town, Iwo is being projected to be about triple by 2030 of the last census figure. This situation and development is expected to impact on water demand and requires urgent attention of all stakeholders. This research is therefore conducted to assess the impact of physical growth and population increase on water demand in Iwo, Osun State, Nigeria. The study examines the water supply status in Iwo and its dilemma in view of the growth being experienced and expected. Also the work assesses the capacity of the AWWs in performing its role of water provision to the inhabitants of Iwo and its suburbs. The work will also assess the adequacy of the ground source of water in meeting up with the water demand of the town, especially in terms of its quality and quantity.

## MATERIALS AND METHODS

### Data source and analysis

The data used for this study were both primary and secondary. Data about the characteristics of hand-dug wells were collected by the researcher and his field assistants. Data acquired in this regard include the depth of water level, coordinates and the withdrawal methods were collected in February, 2021 during which the temperature is usually at its peak. Standardized measuring tape rule was used to measure the water level depth, downloadable android-compliant GPS application was used to determine the coordinates (longitude and latitude) while information on water withdrawal method at different well points was obtained through observation and personal

discussion with respective house heads. Secondary data acquired for the purpose of this study <sup>[16]</sup>. Data from these publications include water scheme projects across Osun State, water supply and demand pattern over three years (from 2011 to 2013). The method of analysis in this work is basically descriptive.

### Study area

This research was carried out in Iwo Township. Iwo, located in Osun State in the southwestern Nigeria, has an area of 245 km<sup>2</sup> with a population of 191,348 according to 2006 population census. It is located on the coordinate axis of 7°38'N and 4°11'E. The prevailing climatic condition is tropical with about eight months of rainfall (March to October) and about four months of dry season (November to February) <sup>[17]</sup>. Ogunbode discovered that annual rainfall in most tropical wet climate regions ranges between 1000 mm and 2000 mm with double maxima in July and September. Iwo habitants are predominantly farmers with high dependence on rainfall for agricultural practices. Apart from this the dominant vegetation is tropical forest comprising hardwoods such as obeche, walnuts, acacia, eucalyptus among others. In addition, the dominant agricultural practice is growing of permanent and annual crops such as cocoa, kolanut, oil palm, yam, maize and so on. However, the dry period in the year is often dominated with farming in the wetlands and along some river banks. Iwo is underlain by Precambrian Basement Complex comprising mostly gneiss, granite, schist, undifferentiated met-sediment rocks and overburden that are comprised mainly of clay, sand and silt soils. These compositions are neither porous nor permeable except where they are deeply weathered or along the lines of weakness. Also, Iwo is drained by rivers such as Ogunpa River among others. In term of water supply, Aiba Water Reservoir located within Government Forest Reservation Area in Iwo forms one of the sources of potable water for home use in the area was commissioned in 1959. The dam has suffered some levels of abandonment over years and it only provide skeletal services to few inhabitants of the town, especially those that live close to the dam area. Thus, as a result of unreliable and erratic supply from Aiba Water Works and, in view of the susceptibility of the surface water to pollutants, inhabitants have resorted to the exploitation of subsurface sources. This source too, is not without its own challenges as water yields from the wells are only dependable during the raining season. The yields from the wells are at their lowest ebbs as a result of intense heat, seizure of rainfall and also shallowness of the wells. Some of these wells are even limited in their use because of their unhygienic location <sup>[18,19]</sup>. Iwo town has a population of 191, 298 by the head count of 2006 (National Population Commission (NPC), 2006). At the annual growth rate of 2.4%, the population of Iwo will be hovering around 206000 by 2016 due to increase resulting from number of births and deaths per thousand. Of greater significance in the components of population growth is migration. This is currently having a noticeable impact on the population growth the town. Today, several people from diverse areas of life are being attracted to this ancient city as a result of some identifiable factors. In the first instance, Iwo, being the location of Bowen University, owned by the Nigeria Baptist Convention, has attracted people into it. People had migrated to the town as workers, students (undergraduate or postgraduate level), entrepreneurs, contractors, researchers and so on. Apart from this, Iwo is the seat of Westland University, Royal College of Public Health and Technology, Empire College of Health Technology, Al Ummah College of Education, Offer|center institute of Agriculture, Shariah College of Nigeria, which used to be in Ibadan before it was relocated to its permanent site at Oke-Afo, Iwo. In addition, quite a number of private secondary and primary schools which are found within the town attract people from the neighbouring countryside such as Kuta, Ile-Ogbo, Bode-Osi, Ife-Odan. All these institutions have contributed

significantly to the population growth of the town. However, with the approval of Federal College of Education proposed to be sited in Iwo, it is expected that this will impact on the population of Iwo when it is fully operational. The popularly and widely known periodic Odo-Ori and Oluwo markets have contributed immensely to the population of Iwo. Both five-day periodic markets attract people from diverse areas into it as buyers, sellers, transporters, labourers among others. The Odo-Ori Market is almost patronized on daily basis with people from nearby cities and villages. Cattle market in Iwo and the dominance of cattle slaughtering business also explain the increase in the population of Iwo town. In view of the impact of these factors on the population of the town, undue pressure is presently mounted on the pre-existing infrastructural facilities, especially, water supply. The performance of Aiba Water Works is still observed to be below expectation. Some of the reasons for this performance as reported by Ogunbode, et al<sup>[15]</sup>. Include poor management, agricultural practices within the perimeter of the reservoir, dumping of refuse, urban sprawl around the dam perimeter, bush burning, eutrophication, degraded vegetation among others. Of vital to the poor performance of the AWWs is the attitude of the government and its preference for the development of groundwater source to pipe-borne water. The preference could be it cost less, requires less skilled personnel, requires less management among others. Change in the government in the State has impacted on the accessibility to potable water as instability in the policies of the government contributes a lot. For instance between 2002 and 2010 attempts were made to develop mini water scheme across the State to make clean water available and accessible to rural suburban areas in the State alongside with the development of groundwater source<sup>[17]</sup>. The scheme was jettisoned in favor of groundwater development through an Agency of the government, Rural Water Supply and Sanitation Agency (RUWASSA) under another administration (Figure 1).

Figure 1. Study area of Osun state in the south western Nigeria.

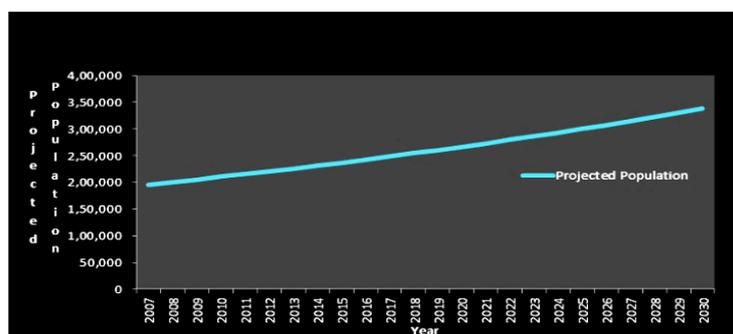


## RESULTS

### Population growth analysis of Iwo

According to the results of 2006 Population Census, Iwo had a total population of 191,348. The annual growth rate of 2.4 implies that Iwo will have a population of 242,559 by 2016, that is, 10 years after the National Population Census Figure 2. Thus, in the same vein, it is expected that by 2030, it is projected that at that rate, the population figure of Iwo would have increased by 76.5 percent since the last head count in 2006. However, the analysis is only about natural increase (i.e. birth and death rates). The projection has not incorporated migration aspect (Figure 2).

Figure 2. Annual projected population of Iwo (2007-2030).



### Impact of migration on Iwo population growth

Iwo town is an agrarian settlement, depending on agriculture as the mainstay of its economy, which implies that many inhabitants would be attracted to other big cities around it such as Ibadan, Osogbo and Lagos which have more industries, tertiary institutions and other better infrastructures which are almost lacked in Iwo. In spite of this, Iwo, in recent times, has attracted many people into it and also has the tendency to still attract more in view of the citing of tertiary institutions, private and public. The centrality of Iwo town to other suburban settlements such as Ile-Ogbo, Kuta, Ife-Odan, Papa, Oluponna, Bode-Osi and other villages around the axis attract young and old into it to enjoy better infrastructural facilities in the town. Apart from this, the location of Bowen University (an institution owned by the Nigerian Baptist Convention) established in 2002, has pulled people into it as students and staff, contractors, researchers and entrepreneurs among others. Apart from this, other institutions that are located in Iwo, and which have impacted on its population include Westland University, Sharia Court Headquarters, Cow Market and many other private institutions. The five-day periodic Odo-Ori market is another point of significance in term of population dynamics in Iwo town. The market is gradually turning to daily market as many people within the surrounding communities and urban centres continue to troop into this ancient town as sellers and as buyers and also to secure menial jobs. Odo-Ori Market is well noted for farm products such as yam, cassava flour (*gari* and *lafun* and its other by-products) among others. Thus people from big cities such as Osogbo, Ibadan, Lagos, Ilorin

and Ogbomoso visit the town almost on daily basis to buy or to sell. These are apart from other small towns around Iwo such as Bode-Osi, Ife-Odan, Ejigbo, Ile-Ogbo, Olupona, Kuta, Ikoyi, Telemu, Asamu to mention but a few. The effect of these immigrants on Iwo manifests in the increase in the number of buildings (both completed and under construction) mostly in the outskirts of the town. The trend of this physical expansion of Iwo is currently calling for a drastic review of the master plan of the town (if any) with regard to infrastructural development such as water importantly. To add to this unprecedented growth of the town is the recent approval and citing of a Federal College of Education in the town, which means that the population of the town will still receive another increase through students' enrolment, staff and other allied settlers.

## DISCUSSION

### Water utilization in Iwo

Ogunbode and Ifabiyi had noted that the dominant use of water in Oyo State rural communities is absolutely domestic. Water is majorly used for cooking, washing, bathing and drinking <sup>[20]</sup>. Even sanitary use of water is abysmally low (2.60%) in the study area. Iwo, in Osun State, shares boundary with Oyo State and also shares similar features, especially in terms of their respective socio-economic characteristics, with the rural communities that were involved in the survey conducted by Ogunbode <sup>[17]</sup>. However, being an agrarian community, the major water use in Iwo is majorly domestic and agricultural. Industrial use of water is still grossly limited for lack of industry. Use of water in small scale industries in Iwo is majorly in the slaughter slabs, car wash stands, local oil mills and gari processing factories. The major source of water for these varied uses is mostly underground. Several ground sources were constructed in several places as hand-dug wells, deep boreholes and also surface sources. Though Aiba Water Works (AWWs) is located within the town for the purpose of providing potable water for the inhabitants, this has not been fully realized to the extent that only few areas that are located few meters away from the dam benefits from this source. Ogunbode, et al. reported that AWWs has not been able to discharge its responsibilities as expected in view of its many bedeviling challenges such as poor management, poor maintenance, corruption and misappropriation of fund, and increase in the population of the town <sup>[21]</sup>. Apart from these highlighted problems Ogunbode, et al. also accounted for the various challenges which may hinder the continuous survival of the dam if drastic measures are not taken by the relevant stakeholders. According to Olutona et al. and Ogunbode, et al. had revealed that inadequate water supply from AWWs has led to the prevailing exploitation of both the ground and surface sources for human consumption. Fortunately, the relatively lower cost involved in groundwater exploitation compared with pipe borne water source have probably made, even the government to shift their focus from proper maintenance and further expansion of Water Works in favor of the latter. To add to this observation is the several research reports on the integrity of the mentioned ground water sources which prove the drinkability of the groundwater in Iwo. Except in few cases of coliform content, the groundwater in Iwo has been adjudged to be fit for human consumption. The eventual consequence of this reports and findings is the gradual shift and abandonment of the pipe borne water development, the only source which has been claimed globally to be the cleanest for water for human consumption <sup>[22-26]</sup>.

### Characteristics of hand-dug wells

Table 3 shows the depth of some selected wells and the mode of extracting water. The groundwater is exploited through the digging of hole to reach the water table either by mechanical or manual means. The mechanical means are used to make boreholes while dug-out wells are constructed usually by manual means. One of the salient features of dug-out wells in is its enormous depth. Most of the wells are deep to about 250 meters as a result of the depth of water table. However, the depth of the wells in Iwo, probably, has offered the advantage of almost all-year-round yield for most of the wells. The adverse consequence of the depth of most of these dug-out wells is the vertical time cost for water withdrawal in addition to the distance covered from the point of use and the fetching point (Table 3).

**Table 3.** Some selected dug-out wells and their respective properties.

S/N	Well label (Location)	Coordinates		Water level depth (ft)	Withdrawal method
		Longitude	Latitude		
1.	A (Kara Area)	4.165205	7.641338	106.46	Mechanical/ Manual
2.	B (Oke Iye Area)	4.171878	7.636892	67.75	Manual
3.	C (Laito Area)	4.17048	7.634057	77.43	Manual
4.	D (Idi-Oke Valley)	4.185067	7.629157	125	Manual
5.	E (Alaye)	4.171596	7.663419	116.14	Manual
6.	F (FRSC Area)	4.166413	7.634462	77.43	Manual
7.	G (Ebu-Aweri Area)	4.176267	7.635378	67.75	Manual
8.	H (Opp. BHS Area)	4.161908	7.628820	33.89	Manual
9.	I (Reality Area)	4.160788	7.630733	72.61	Manual
10.	H (Olukotun Area)	4.176658	7.639197	33.89	Manual

**Surface water status**

Iwo is also blessed with surface water resources such as Oba River, Osun River, Ori River and Aiba River, which, in particular, was dammed in 1957 to provide water for the town. There are other streams which flow through the town in addition to these major rivers that flow through the town or through its outskirts. Virtually all these surface sources, especially those that flow through the town like Yanyanhun (Plate 1), Ponyan and Yemoja rivers have been grossly contaminated and used as refuse dumps along their respective reaches, thus making it unsuitable for human direct consumption. The usefulness of most of these rivers/streams include in the local oil mills, car wash, slaughtering slabs among others. The water from these sources requires thorough treatment for it to be consumed by man either as drinking water or for cooking (Figure 3).

**Figure 3.** Yanyan-hun river in Iwo filled with refuse in the dry season.



## CONCLUSION

An unabated growth in the population of Iwo which culminates the physical expansion of the town will imply undue pressure on the pre-existing infrastructural facilities, especially water. It was on this premise that an investigation into what the nearest future holds for Iwo town with regard to water supply. As a result of increasing growth in the population and further expansion being envisaged. Presently, the performance of the only AWWs established as far back as 1958 is visibly seen to be below expectation. The WWs is bedeviled with myriads of challenges bordering on poor management, urban sprawl, refuse dumps within the perimeter of the reservoir among others. Apart from this the skeletal services being rendered by the WWs are only beneficial to those living within few meters to the WWs. This was found to have consequence on the reliance of the inhabitants on groundwater resources. Surface sources are grossly inappropriate for human consumption except the water from it is thoroughly treated. As an alternative to this, ground source has been resorted to. Thus, private efforts in the construction of hand-dug wells, government, through its agencies and also notable philanthropists and religious organizations contribute a lot to the proliferation of hand-dug wells in the ancient town. The investigation carried out in the month of February, 2021 showed that even these wells are on the average of 88meters deep and of an average of 10 to 15 minutes trek. The integrity of the water get distorted in the course of conveyance to the point of use. With the current trend of expansion, stakeholders in water sector, especially, the Osun State Government holds the responsibility of ensuring that the WWs is overhauled to fit to perform its statutory roles in ensuring timely access to clean water to meet up with the teeming population in the town.

## REFERENCES

1. Bloch R, et al. Urbanization and urban expansion in Nigeria. 2015.
2. Mahmoud ML, et al. Analysis of settlement expansion and urban growth modelling using geoinformation for assessing potential impacts of urbanisation on climate in Abuja city, Nigeria. *Int J Remote Sens.* 2016;8:220.
3. Wijitkosum S, et al. Impact of urban expansion on water demand: The case study of Nakhonratchasima City, Lam Ta Kong Watershed. 2018.
4. Lyons WB. Water and urbanization. *Environ Res Lett.* 2014; 9: 111002.
5. Padowski J, et al. Global analysis of urban surface water supply vulnerability. *Environ Res Lett.* 2014;9: 104004.
6. Bello-Schünemann J, et al. African urban futures. Institute for Security Studies. Frederick S. Pandee centre for international futures. 2016; 20: 36.
7. Saghir J, et al. Urbanization in sub-Saharan Africa- meeting challenges by bridging stakeholders. Centre for strategic and international studies. Project on Prosperity and Development. 2018; 17.
8. Ogunbode TO, et al. Proceedings of a special virtual conference on COVID-19 of the association of Nigerian geographers (Southwest Zone), Held via Zoom, June 29 -30. 2020.
9. Macheve B, et al. State water agencies in Nigeria: A performance assessment. 2015.
10. Van de Lande L, et al. Eliminating discrimination and inequalities in access to water and sanitation. United Nations Water technical Advisory Unit, Switzerland. 2013.
11. Jankielsohn R. Defining hydro-politics: The politics of water in South Africa. *J Contemporary History,* 2018;37:123-141.
12. Morales-Novelo JA, et al. Inequality in access to drinking water and subsidies between low and high income household in Mexico City. *Water.* 2018;10:1023.
13. Gomez M, et al. Socioeconomic factors affecting water access in rural areas of low and middle income countries. *Water.* 2019: 11:20.
14. Jacobsen M, et al. The future of water in African cities: Why waste water? 2012; 20433.
15. Ogunbode TO, et al. Sustainability and resilience of Aiba Dam in Iwo, Nigeria. *J Appl Sci Environ Manage,* 2019; 23:1937-1942.
16. Ojo O. A Study of the rural water supply-demand situation in South West, Nigeria. *Water Resour Manag,* 2011;145: 51-61.
17. Ogunbode TO, et al. Determinants of domestic water consumption in a growing urban centre in Osun State, Nigeria. *Afr J Environ Sci Technol.* 2014; 8: 247-255.
18. Ogunbode TO, et al. Domestic water utilization and its determinants in the rural areas of Oyo State, Nigeria using multivariate analysis. *Asian Resear. J Arts Soc Sci.* 2017; 3:1-13.

19. Akinola OT, et al. Borehole water quality characteristics and its potability in Iwo, Osun State, Nigeria. *J Sci Resear Rep.* 2018; 18:1-8.
20. Ogunbode TO, et al. An assessment of seasonal variations in physic-chemical characteristics of underground water in a growing tropical city in nigeria. *Ethiopian J Environ Stud Manage.* 2017; 10:378-388.
21. Ogunbode TO, et al. Assessment of underground water quality and pollution sources apportionment in a growing urban centre in Osun State, Southwestern Nigeria. *Eur J Geogr.* 2016; 7:71-85.
22. Ibrahim RB, et al. Evaluation of the public pipe-borne water supply in Ilorin west local government area of Kwara State, Nigeria. *Environ Econ.* 2018;18:1105-1118.
23. Makwe E, et al. Comparative assessment of pipe-borne water and groundwater quality and their health implication in gwagwalada town, Nigeria. *Int J Innov Resear Dev.* 2020;9: 222-236.
24. Pophare AM, et al. Impact of over exploitation on groundwater quality: A case study from WR-2 Watershed, India. *J Earth Syst Sci.* 2014; 123:1541-1566.
25. Santos S D, et al. Urban growth and water access in sub-Saharan Africa: Progress, challenges, and emerging research directions. *Sci Total Environ.* 2017;497-508.
26. Tukur AI, et al. Groundwater condition and management in Kano Region, Northwestern Nigeria. *Hydrology,* 2018;5:16.