

# Public Action Deficit in the Implementation of Drinking Water Supply Policies and the Socio-spatial Strategies of the Populations in the City of Douala 5 (Littoral-Cameroon)

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**Abstract**—Water in adequate quantity and quality is a fundamental requirement for the survival, well-being and the socio-economic development of mankind. Despite the fact that water occupies more than half the total earth surface, many parts of the world do not have access to fresh and good drinking water. This paper is devoted to the study of the governance of drinking water resources in cities of developing countries (DCs) experiencing uncontrolled urbanisation. The study aim to evaluate the contribution of public actions put in place for the reinforcement of the public water services. In order to achieve this objective, anticipatory response was formulated. The main assumption is that in the cities of tropical African countries especially in that of Douala 5 Cameroon, the governance systems put in place for the reinforcement of the public water services are incoherent, ineffective and inefficient in ensuring sustainable access of the populations to drinking water, and is responsible for the development of socio spatial strategies in the city and consequences public health risks problems. The verification of this hypothesis was based on the hypothetico-deductive method. A questionnaire survey was conducted among 360 households with a quota of 30 households per neighbourhood.

This study shows that, political, economic, social, financial, environmental and the historical factors (governance dimensions), that structured the current water resource management are marked by numerous gaps and constraints. Poor access to drinking water and sanitation, pollution of water resources, water-borne diseases, increasing demand for water, incoherent, ineffective, inefficient legislative, regulatory and institutional frameworks for urban water management, increase in urban poverty, degradation of the living environment, ... are all constant combined driving forces pressures impacts that contribute to the gradual impoverishment of households and hinder the development of the area in particular and that of the city of Douala in general. As a result, relations between men have become more pronounced

and social inequalities have become clear. The poor management of water resources in the Douala 5 area is an indicator of an urban governance crisis.

**Keywords**—drinking water governance; public actions; Developing countries; Douala 5; water borne diseases.

## I. Introduction

Access to safe drinking water for the poorest populations is one of the concerns of the United Nations. Since 1977, water has been declared by the United Nations as a "common good" to which every individual has a right of access. The Millennium Development Goals (MDGs) was to reduced halve the number of people without access to safe drinking water and sanitation by 2015, and today the Sustainable Development Goals (SDGs) aim to ensure access to water and sanitation for all by 2030.

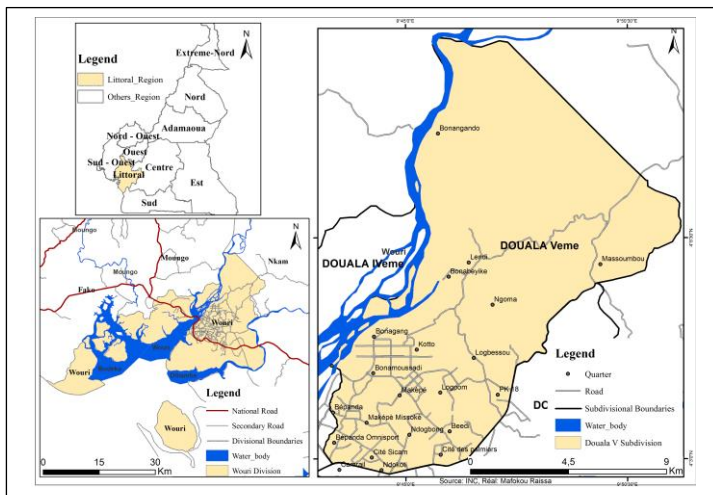
In the underdeveloped countries, 80 % of diseases are linked to water. One among two Africans suffers from water-borne diseases, two million people especially children under five suffer from diarrhea and one million from malaria. During the 1970s, Douala 5 had a population of less than 57.000 inhabitants, water from alternative sources did not present a huge danger since the sources of contamination were minimal. Little by little around the 90s, the growth of the population is felt, the demand for water is growing, the sources of pollution multiplied and the need to set up hydraulic projects to bridge the gap became a necessity. In the city of Douala, water is abundant with an underground reserves of about **158 46 500 m<sup>3</sup> /year**, an estimated inflow of 600.10<sup>6</sup> (BANDJI, 1994), and a dense hydrographic network. Despite these large water reserve, a large segment of the population do not have access to drinking water and turn to the multiplicity of alternative sources. Water supply from several sources, is a compensation mechanism in the face of problems of access to water. What are the supply methods, strategies and forms of adaptation developed by water stakeholders? The objective of this paper is to present the limits of public actions in

the supply of drinking water to the population of Douala 5 with an assumption that, the deficit of public action to supply the population of Douala 5 with drinking water has an impact on the population and is a source of emergence of socio-spatial strategies in the city. This paper opens with the presentation of the study area, research methodology, the public action deficit in the implementation of drinking water, the population response to the inequalities induced by the implementation of public action and the Public health problems due to public action deficit in Douala 5.

## II. Location of the study area and methodology

### 2.1. Location of the study area

Located in the inter-tropical zone in the Gulf of Guinea in the Wouri estuary at 30 km from the Atlantic Ocean and not far from the equator between latitude  $4^{\circ} 3'$  and  $4^{\circ} 7'$  North and longitude  $9^{\circ} 42'$  and  $9^{\circ} 48'$  East. Douala 5 was created by Decree No. 093-321 of 25<sup>th</sup> November 1993, it has an estimated surface area of 21,000 hectares<sup>1</sup> with a population density of 4095 inhabit/km<sup>2</sup>, a maximum altitude of about 80m and according to the Cameroon general population census (Bucrep, 3<sup>eme</sup> RGPH 2010) has a total of 544919 inhabitants with masculine (272492) and feminine (272427). It is the second largest Municipality after Douala III, bounded by the Nsape Drainage Basin to the North, Douala II and the Wouri River to the West and Douala III to the East and South. The below figure 1 present a geographical location of our research area.



Author: Researcher, 2022

Figure 1: Location of the study area

### 2.2. Methodology

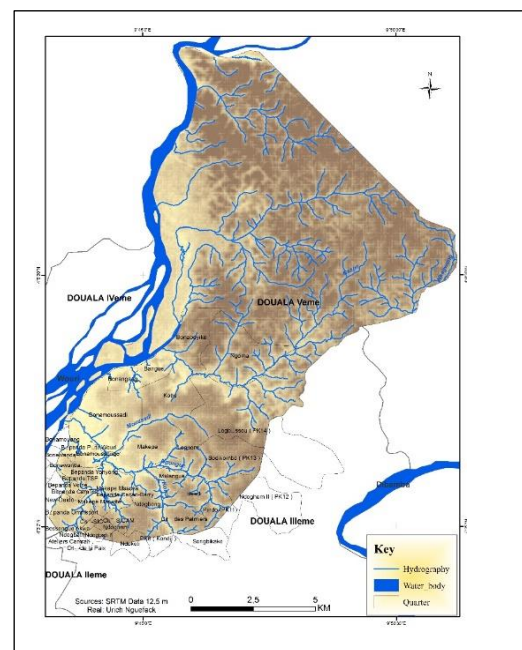
Our methodology is based on the administration of a questionnaire to households in the city after direct observations and semi-structured

<sup>1</sup> Source: Douala V municipal council, 2009

interviews with key informants. This questionnaire aimed to assess public actions in water supply, difficulties in accessing water by households, and to evaluate community strategies to find solutions. It was completed by the analysis of some public health problems linked to the deficit of public actions. After categorising neighbourhoods according to water supply difficulties, a sample of neighbourhood's representative of the most disadvantaged in terms of access to drinking water was chosen, and 360 households were surveyed according to a random sampling.

### 2.3. Douala 5: a city with sufficient water resources, but deteriorating

The climate, the geographical position and the hydrographic network are all elements that potentially protect Douala from water needs (Nantchop 2017). We are in an equatorial region with no more than three dry months (December to February). However, over the past 15 years, there has been a downward trend in precipitation, both in terms of intensity and periodicity. This is reminiscent of the increasingly talked about climate change, but also locally reminiscent of poor watershed management, and rightly demonstrates that the future will be even gloomier in terms of water supply for urban households. The challenges are therefore enormous.



Author: Researcher, 2022

Figure 2: The hydrographic network of Douala 5 watershed

The hydrographic network of the coastal river basin of Douala 5 is very dense. It comprises many streams which flow into the sea through mangroves and a large estuarine area. The intensity of the

network and its regularity guarantee a stable and secure water supply. The relief of the subdivision is characterised by a plain morphology consisting of small hills not exceeding 60 meters in height. This hills are made up entirely of sedimentary terrain, and are cut by a dense and sinuous network of streams and brooks, tributaries of coastal rivers. The landscape has a sheepish aspect separated by valleys. This rivers has a high flow rate, influencing drinking water supply. This watercourse feeds three treatment plants which are the water towers of the city of Douala: Yatto, Japoma and Massoumbou plant station.

The geographical location of Douala 5 reinforces Cameroon's position in terms of availability of an enormous quantity of water, reason why in the year 2000, it was ranked among the countries with abundant water resources (Fonteh, 2003). Since availability is not synonymous with accessibility to drinking water, these physical predispositions are not a guarantee in terms of the water wellbeing of Douala 5 city dwellers.

### III. Public action deficit in the implementation of drinking water supply to the population in the city of Douala 5

Having water resources in their natural state is one thing, but making them safe and accessible to everyone is another (Sufo, 2010). The public policies on drinking water has and is facing serious problems in its implementation and execution in the city of Douala 5. These problems are characterised by the following constraints:

#### 3.1. Mode of access to drinking water in Douala 5 between inadequate supplies of services

The distribution and reinforcement of the public drinking water service in the municipality of Douala 5 comes from the three production treatment plant station (JAPOMA, YATO, and MASSOUMBOU) that supply drinking water to the entire urban population of Douala. The distribution configuration is organised by CAMWATER.

The drinking water distribution scheme of the city of Douala 5 is made up of two main networks whose delimitation takes into account the city's topography:

- ✓ A low network covering the lower part of the city (low altitude); and
- ✓ A high network covering the upper part of the city (high altitude).

The high network covering the upper part of the city, supply drinking water in neighbourhoods such as Bonamoussadi, Makepe, Logpom, Kotto, Bonangang, Bépanda, Cité SIC of palmiers and which occupies an area of about 25 Km<sup>2</sup>. This part of the city is also known as Douala Nord and is the area with a strong connection to the water supply network. The low network covering the lower part of the municipality is

also known as the Douala North South supplying drinking water to the low standing and peri-urban inhabitants of the municipality. This is the part of the water supply network where there are the most problems with water supply shortages and consequently there is a need for network extensions and reinforcements.

The current extent of the drinking water supply network in Douala 5 covers a large part of Douala North (the upper city). However, in the field we distinguished the following categories:

- The areas connected in a very dense and sufficient manner, where there is a majority of individual connections. These are the Douala North and Deido West housing estate. It should be noted that the industrial zones of Bassa and Bonabéri, as well as the Nyalla military camp, are also very well covered by the CAMWATER network.
- The areas connected in a more disparate manner, with individual connections but also numerous collective water points. This category includes most of the city, notably the northern districts of Sodikombo, Ndoghem, Bépanda, Ndogpassi, Maképé, Logpom, and more generally the neighbourhoods along the main roads.
- Sectors with very poor or no access to the drinking water network. This concerns, among others, certain districts of Maképé II Yoyong, Maképé I, Logbessou, Nkondi, Ndogsimbi, Bangué and all the areas located along the main road, as well as all the spontaneous urbanisation sectors located at the north western and eastern ends of the town.

The contribution of the different sources to the supply of water in the city of Douala can be seen in table 1.

**Table 1: State of water production and distribution in the city of Douala**

Production unit	Nominal production (M <sup>3</sup> /d)	Current production (M <sup>3</sup> /d)	Volume of technical losses (M <sup>3</sup> /d)	Storage tank capacity (M <sup>3</sup> )
JAPOMA	65.000	55.000	10.000	5000
MASSOUMBOU	40.000	28.000	12.000	3500
YATO	150.000	100.000	50.000	16.500
Urban Drillings	14.400	8.000	6400	1000
<b>Total</b>	<b>269.400</b>	<b>191.000</b>	<b>78.400</b>	<b>26.000</b>

Source: Researcher, 2019, CDE report

From the above table 1, we observe a strong irregularity in the volumes of water distributed to



users. This is due to the fact that, the ageing of the installations is accompanied by average technical losses of around 30%. These are due to the existence of old pipes, informal connections and tampered meters. Thus, out of an average daily production of 269.000 m<sup>3</sup>, approximately 191.000 m<sup>3</sup> are distributed to customers and 78.400 m<sup>3</sup> lost in the network. It is very important to mention that the current production capacity of the treatment plants we see is for the entire Douala agglomeration which constitutes six subdivisions. According to a report from the CDE Directorate 2019, the consumption of the Douala 5 district represents 25% of the total consumption (47750 M<sup>3</sup>/d), equivalent to **47.750.000 l/d**.

### 3.2. Water consumption on the network of Douala 5 between inadequate supply and urban population growth

The demand for drinking water in the Douala 5 agglomeration is not keeping pace with its growth. Douala 5 has experienced a demographic evolution in several phases since its creation for an arithmetical increase of water points.

The data on network consumption that we used are essentially those for 2019.

At our level we registered 27,200 physical installations (metered or unmetered). For these installations, we have 23,500 subscribers in the entire subdivision.

✚ The Bonamoussadi sector (distribution network) has 17886 subscribers for 21525 delivery points.

✚ The Ndogbong sector (recovery plant station) has 5614 subscribers for 5675 delivery points.

These subscribers (the entire Douala 5) are divided into 6 categories, namely:

1. Individuals (households);
2. Large consumers (industries);
3. CDE agents and services;
4. Administrations;
5. Communal buildings;
6. Communal standpipes.

**Table 2: Distribution of subscribers by category in Douala 5.**

Subscribers	Individuals	Industries	CDE tag & service	Administrations	Communal buildings	Communal standpipes	Total
Number	21 880	707	408	490	10	5	23.500

**Source:** field investigation, CDE report, 2019.

From our table 1, the **21 880** individual households subscribers theoretically constitute only

**159 505<sup>2</sup>** people, if we keep to the fact that the average household size in Douala according to the RGPH (1987) is 7.29; this gives us at most a coverage rate of **23.8%** of the total urban population. Table 2 below present the proportion of access rate to drinking water.

**Table 2: Estimation of the proportion of access rate to drinking water by individual subscribers in Douala 5.**

Population	Size	%
Subscribe	159 505	23,8%
Unsubscribe	539 162	77,2%
<b>Total pop (2019)</b>	<b>698667</b>	<b>100%</b>

**Source:** field investigation, 2019

Taking into consideration the consumption threshold of 50 l/d/inhabt in medium-sized Third World cities as defined by Bonnin J. (1977), Kulbermattan J.M. (1998), then Djeuda et al. (2002), and the average household size at 7.29 (RGPH 1987), the average daily consumption of a subscribe household would be **364.5 l<sup>3</sup>**. Considering that the 21 880 subscribers consume a total of **7 975 250 l/d<sup>4</sup>**. We note that consumption is lower than production. If we add the consumption of the city's companies, and other food processing companies, administrative blocs, communal buildings, laundries, hotels, hospitals and schools, we realise that this production is below satisfactory.

### 3.3. The cost of access to CAMWATER services remains high for the majority of urban dwellers

The market model requires that access to water has a price (C. Baron and A. Isla 2005, L. Breuil 2005). Even if the parastatal company that distributes it in a quasi-monopoly situation defends itself from the label of water trader, it is necessary to recognise that there is a cost, whether symbolic or not, which limits access to state water for all. It depends on the distance and infrastructure parameters to be used. The table 3 below summarises the parameters that enter into the cost of the water distributed by CAMWATER.

<sup>2</sup> Number of subscribers X the average household size (21 880 X 7.29 = 159 505)

<sup>3</sup> Consumption threshold X average household size (50 l X 7.29)

<sup>4</sup> Total subscribers X consumption threshold (159 505 x 50)

**Table 3: Minimum official costs of a connection to the Camwater network in Douala 5.**

Price evolution (1970-2019)		Pricing of connections (2019)		
Years	Price/m <sup>3</sup> in Fcfa	Diameter (cm)	Flat rate value for connection ≤ 5 m (F cfa)	Extra charge every 5 meters ( in Fcfa)
1970	65	15	61605	2280
1980	85	20	70765	2750
1988	196	40	104 020	4225
1997	337			
2008	347 or 415			
2019	347 or 415			

Meter diameter (cm)	Advance on consumption (in Fcfa)	Meter installation costs (in Fcfa)	Total (HT)
15	19 205	4 535	23 740
20	24 000	4 440	28 440
40	96 015	7 275	103 290
80	264 040	16 800	280 240
100	384 055	20 405	404 460
150	600 080	24 005	624 085
200	960 135	28 800	988 935
250	1 560 215	36 005	1 596 220

**Source:** Researcher, CDE (2019)

From 1971, when SNEC was commissioned, to 2005 for CAMWATER until 2019, the price per m<sup>3</sup> of water has risen from 65 francs to 347 francs, an increase of more than 282 francs. The repercussions were quickly felt at the tap. The price of water went from 5 FCFA for 10 litres to 10 FCFA for the same quantity. Large consumers pay 415 FCFA per m<sup>3</sup> (Nantchop, 2019). The price of the connection varies according to the distance between the concession and the main pipe and especially the diameter of a meter. In addition, a subscription is required, the minimum cost of which in 2019 remains at CFAF 23740.

In addition to the content and the administrative hassle, one has to pay the monthly meter rental fee of 1,005 CFA francs, and when the customer defaults, he or she pays late penalties. Although they are calibrated, it is the last standard, i.e. 4570 FCFA, which is often applied to latecomers. According to very small estimates, if a city dweller wants to have water at home in Douala 5, he or she will have to pay at least 120,000 CFA francs in 2019. As can be seen, water in its natural state is available for the city of Douala, but the distribution company in a monopoly situation does not manage to capitalise on it to redistribute it efficiently and equitably to city dwellers. City dwellers excluded from this network must either find individual solutions such as the

construction of wells with all the health risks that this entails, or join together for community solutions.

From our survey, 90% of respondents say the cost of connection or simply subscription to CAMWATER service is not clear to most users and that no figures on the cost of connection are available on the company's website. The connection costs paid range up to 650,5000fcfa. Mme Nanfack christelle, a resident of the neighbourhood of Makepe Missoke, says:

“My name is NANFACK Chistelle, I am a resident of Makepe Missoke, and I have been a Camwater subscriber since 2000. During my installation to the network, the absence of a water pipe near my home forced Camwater's technical staff to connect me more than 50 metres away. A few years passed, and I found that I was overcharged, even though I did not have regular access to water at home. If the meter was close to my home, I could check and control my consumption at all times. Between leaks and thefts, it is very difficult to secure your consumption if the meter is too far away from your resident.

To this effect, I tried to approach Camwater and the agency officials about this situation at several occasions without success. The problem continued and worsened over time. In view of this situation, I stopped paying my water bill due to the total absence of water from the tap for a month.

A few weeks later, a Camwater agent gave me two invoices corresponding respectively to the notice of disconnection and meter maintenance with a total of 35, 000 FCFA. This amount was exorbitant since I did not use water for the past one month. But I had to pay these bills, to avoid the cancellation of my connection, I had no choice. After that, the situation remained unchanged. Discouraged from paying these unreal amounts unnecessarily, I finally decided to cancel my subscription. To me I believe that, if the main pipes ran closer to the houses, there would be no such problems: we would have visibility on our meters and on the breakdowns regularly caused by vehicles breaking the pipes along the lines”.

**Box 1: Explanations from a resident at Makepe Missoke of the difficulty face when far from the State-owned CAMWATER network**

### 3.4. Power outage and frequent network breakdown: another ordeal for users of the public water services

People who have access to the urban water system (who are directly connected to it or through intermediaries), does not mean that their daily lives are without suffering to get water. In fact, the water distribution service has been deteriorated considerably in Douala, and the technical losses recorded are in the order of 30% to 40% (Nantchop, 2017). Above all, the poor state of the network causes very frequent breakdown: during our field survey, about 95% of respondents said to have experienced a breakdown. The various breakdowns or problems cited by the inhabitants, customers of CAMWATER are: malfunction of meters, low flow, problem with bills, disconnections and power failures. The respondents further replied that most of the problems are caused by broken pipes, causing

constant cuts in the water supply network. An inhabitant of Bepanda Petit Wouri told us in the field that *"in my area, the pipes are not buried deep enough, they are regularly broken, and water sometimes spills out for several days before it is fixed"*.

The city of Douala is supplied by two 800mm diameter pipes, tapped at the Japoma treatment station. The entire Douala network is supplied by these two pipes: one supplies the lower part of the city while the other supplies the upper part of the city. One of the technical manager of CAMWATER explains: *"The frequency of breakdowns varies according to the type of work realised in the city. It can be caused by the redevelopment of urban roads as is the case at the moment with major road works"*. However, the inhabitants report of a much more frequent breakdowns than those due to urban works, even if the latter can indeed cause prolonged outages.

Moreover, the residents who testified explained that in 75% of cases of breakdowns, they are the ones who provide maintenance, compared to only 25% of situations where a CAMWATER technical officer carries out the repair. The average cost of these repairs by individuals is about 7000fcfa. When a CAMWATER agent is required to intervene, some repairs are free of charge, but others can cost up to 150.000fcfa among the examples given. In addition, the response time of CAMWATER, for breakdowns that cannot be dealt with by private individuals is very variable, and can take more than a week. However, once the repairs has begun, customers report that in 95% of cases the problem is resolved in less than 24 hours.

Many inhabitants in neighbourhoods that are not residential or administrative, declared that cuts-off are much more common in their neighbourhoods than in other areas, which are more preserved. Information on cuts-off not available (the announcements on the CAMWATER website do not report any outages in the city of Douala for the whole period 2018 – 2019 while many cuts could be observed). This information is impossible to confirm or deny. Mme. ASONTSA Marie, explained to us the following in box 2:

"My husband subscribed to a connection to the network in 1990, with SNEC. At that time everything was going well, there was a strong water flow, and there were few cuts-off at home. As from the year 2002, I started observing many irregularities: low flow, untimely water cuts and changes in water colour. Faced with this problem, my husband and I asked the index reader (SNEC agent) to give us an explanation. This agent explained to us that the large pipes were under construction reason while the water was almost yellow in colour, but that the situation would soon be restored. We waited for three months, but the situation remained unchanged. The children were forced to get up at 4 a.m. every day, walk about 2 kilometres in search of water.

Overwhelmed by the situation of prolonged and very frequent cuts-off, not a week went by without a break, sometimes for several days, my husband and I decided to terminate our subscription in 2005 despite the enormous damage it could cause, because it is not easy to get supplies from outside the network.

After the death of my husband in 2010, and the move of my children's to other cities, it was very difficult for me to get drinking water because of the distance from the private well where I was buying water at 10 FCFA, a 20 litre container at that time. Faced with this suffering, I decided in 2011 to re-subscribe to the CDE (Cameroon Water Company) water service. I was hoping that with the arrival of the new dealer (CDE) the situation would change, that the water service had improved. But the water cuts persisted and my bill was still high. The power failure began again.

In 2013, road construction by the military engineers made the situation worse with the destruction of the main pipe that supplies my house: water was completely cut-off. Despite multiple visits to the CDE Bonamoussadi branch to report the absence of water for several weeks and months, nothing changed. We had no water and I continued to receive bills for meter maintenance at 1,005fcfa each month. But I couldn't terminate again and we didn't know when the water was going to be turned on, it could happen at any time. 5 years passed again and the situation maintained and in 2018 is discovered that mostly all of the inhabitants of my neighbourhood had the same problems when I told them my problem. With the other people concerned we decided to organised ourselves in a group so as to address our problems to the Director General of Camwater. We had to persevere and after several unpaid approach, we decided to go to the General Management in Bonanjo, to question the Director directly. Thanks to this mobilisation, we were able to meet him the same day, and we were reconnected to the water network. In addition, the accumulated meter maintenance costs from the 6 years without water could be compensated by free water in the following period.

Today I have water flowing even-though with low pressure, but regular and I am free from water-borne diseases like diarrhoea. It is important to work in group because together we were able to be strong and get our problems solved".

**Box 2:** Testimony from ASONTSA Marie, a resident at Kotto Village of the difficulty face in the use of the public water service.

#### IV. Populations response to the inequalities induced by the implementation of public action

Face with the deficit in public actions to supply the population with drinking water, to meet their daily needs they are forced to adapt to the scarcity by resorting to unimproved water points.

#### 4.1. Boreholes, wells and springs as a new mode of access to drinking water

Drilling is an indicator of modernity in the Douala 5 villages and neighbourhoods. The ages of the boreholes vary between 1 and 15 years with a predominance of boreholes with less than 10 years old. These are recent works that are part of the new strategies implemented by the wealthier social classes to overcome the problem of lack of drinking water. Boreholes are, like other types of construction, means of adaptation to water scarcity and elements of modernisation. They are the work of the elites, development partners and the municipality and are part of their achievements to improve the living environment.

The dominant mode of supply, whether in densely, medium or sparsely populated areas, remains wells after boreholes. However, the villages at the foot of the plateau and in the swampy areas in the north-eastern part are to a greater extent supplied by water from springs and sources (Kotto village, Maképé old dump and Ndongbong).

The alternative sources, represent the highest strategy developed by households to meet their water needs. Some households collect rainwater in barrels, basins, buckets, or jerry cans during the wet and rainy season which they used exclusively for domestic purposes (laundry, cleaning the floor, etc.). It is never used as drinking water except in rare circumstances of water scarcity as explained by some household we came in contact in the field.

**Table 4: Distribution of surveyed participants in function of the mode of access to water in households**

Council	Water used	Number of households	%	Rank
Douala V	Drilled wells/borehole	76	21%	02
	CAMWATER/CDE from home	38	11%	05
	CAMWATER/CDE from neighbour	89	25%	01
	Collective wells	55	15%	03
	Individual wells	13	4%	
	Mineral water	40	11%	04
	Fountains	18	5%	07
	River/spring	20	6%	06
	Other sources	12	3%	08
Total		360	100%	

**Source:** Researcher, 2019

From our table 4, the different modes of access to water supply are not uniformly repartition in the different quarters that constitute the municipality of Douala 5. There are indeed disparities within and between the different neighbourhoods.

Water from wells, springs and other sources of questionable quality constitute about 2/3<sup>rd</sup> of households (about 28%) mode of access. This households from our survey carried out in the field told us that they treat water before usage. They use bleach (javel), salt, water filter or the technique of settling (decantation).

The collected water in various households is intended for a variety of uses depending on the origins as shown in the following (table 5).

**Table 5: Distribution of water used in function of their different origins**

Origins of water	Water usage						Remarks
	Drinking	Cooking	Floor cleaning	Laundry	Toilet	All usage	
Drilled wells/borehole	26,4%	24%	6%	6%	8%	43%	Mainly used for drinking and domestic activities
CAMWATER/CDE	43,1%	15%	5%	4%	7%	26%	Mainly use for drinking, cooking and multi-purpose
Well water	-	6%	18%	18%	14%	7%	Dominantly used for domestic activities
Rain water	11,1%	6%	8%	7%	4%	8%	Use for drinking, cooking and multi-purpose
Mineral water	13,9%	-	-	-	-	1%	Dominantly use for drinking
River	-	-	6%	51%	28%	-	Mainly use for laundry and toilet
Source/spring	8,3%	5%	13%	13%	6%	14%	Mainly used for domestic activities
Total of respondents	100%	56%	56%	99%	67%	99%	

**Source:** Researcher, 2019



In view of this table, it appears that the use of water by households is strongly conditioned by its origin. Water of questionable quality is strongly used for activities such as cleaning of floor, laundry, washing and sometimes cooking of food. Water from CAMWATER/CDE and from boreholes are dominantly used for drinking. It is also important to note that water from these different structures is generally used concomitantly, an element that can justify the cumulative percentage in relation to "uses" or "origins". The low percentages obtained in terms of total "cooking", "floor cleaning" and "toilet" results from an underestimation and or absence of certain resources (water from network).

In terms of multi-purpose uses from our table, boreholes (43%) is mainly used for drinking and other domestic activities and therefore represent the highest form of water used in the municipality of Douala 5 due to the absent of CDE in most peripheral zones. It is followed by CAMWATER/CDE representing 26% of total water use and mineral water 1% which is used only for drinking by some moderate and high standard citizens. The following plate 1 is a photographic illustration of a diver's mode of access to alternative sources in the Douala 5 subdivision.



Source: Researcher, 2019

Photograph 1 is a developed community well located at Bonangang; photograph 2 roughly developed community well located at bloc 8 Makepe Maturite; photograph 3 represent an Undeveloped springs (US), located at Kotto village (Paka); Picture 4 represent a roughly developed Springs (RDS) located at Maképé ancienne decharge and Ndogbong; Photograph 5 represent a Borehole equipped with electric pump at College Dophine (Ndogbong); photograph 6 is a Borehole equipped with human motor pump (HMP) of type India Mark at LOGBESSOU. Their common characterised is that they are for multipurpose usage.

Figure 3: Alternative mode of access to drinking water in the Douala 5 districts

In terms of distance between the main water points, the average distance in search of water is about 100,2m. The amount of water used per household are variable (10 l to 500 l) and depend on the size and composition of the household, the proximity of the water point to the place of residence, the activities carried out within the household, the cost of access to water and the modality of access to water. The average amount of water consumed is around 15 l per person per day. It is lower than the minimum amount of water (20 l per person per day) recommended by WHO (2008a).

It should be noted that, the task in terms of distance covered in search of water by household most especially made up of boys and girls is not always easy because the distance ahead is at time very considerable and this situation constitute a real problem for a big city like Douala. Moreover, 14% of households have to cover a distance greater than 500 meters in order to acquire this precious liquid whose potability in most of the time is questionable since water can be easily contaminated during transportation. The following table 6 present the distance covered by households in search for water in the city of Douala 5.

Table 6: Distance covered by households in search for water

Distance covered (m)	Number of households	Percentage
0 to 50	180	50%
50 to 100	35	10%
100 to 500	94	26%
More than 500	51	14%
Total	360	100%

Source: Field investigation, 2019

From the above table 43, in terms of distance covered in search for water 180 households (50%) affirms to trek less than 50 meters, 10% confirm to cover about 100 meters, 26% cover 500 meters and more than 14% trek above 500 meters to fetch water. Most of this age groups are adolescent (10 to 15 years) and the youths population (20 years above) who sacrifices much of their time which could be



used for other lucrative activities, instead convert in search for water trekking longer distance of which the quality are questionable.

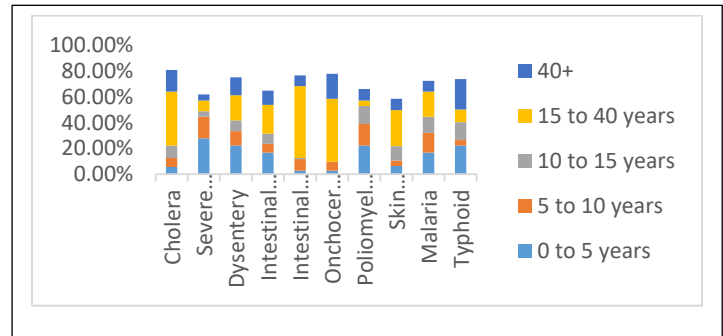
#### 4.2. Public health problems due to public action deficit in the supply of water in Douala 5

##### - *The proliferation of water-borne diseases an indicator of urban inequalities*

In a general sense, water-borne diseases are linked to the quality of water and the level of access. It may be water used for drinking, cooking, bathing, or even to wash objects. The most direct risk of transmission is related to drinking water. The transmission of pathogen can also occur through wounds or through the passage of a parasite through the skin. The decrease in the quantity of water distributed result in the use of alternative sources. In particular, the conditions for collecting, transporting, and storing water degrade its quality. Households with low income levels or living in the periphery are the most affected by these diseases. In Douala 5 faced with the scarcity of water, the daily practices of the populations aiming at storing and improving water quality, have serious consequences to their health. In addition, high population densities in certain neighborhoods coupled with housing problem result to the deterioration of water quality and consequently the ground water table, affecting the health of the populations.

##### - *Water, a primary causes of diseases*

Water-borne diseases are most common in our cities, they mainly affect women and children (Guevart et al., 2006). Besides the insufficient access to drinking water, the physical conditions and the multiple sources of pollution of the water table are causing the upsurge in water-borne diseases. Most of the unplanned neighbourhoods are developed in areas of low altitude, where the water table is almost close to the surface. In this under equipped and low cost neighbourhoods, such as Bepanda, Maképé, Bangué etc... the age group between 0 to 4 and over 44 years are the most exposed to these diseases. Severe diarrhoea, typhoid and malaria are the most leading cause of infant morbidity and mortality in the city (CUD, 2004). They are found in high proportions in children under one year of age (example of severe diarrhoea, 27, 8%). The below figure 4, present households age group in function of water-borne diseases.



**Authors:** Researcher, 2019, produced using data extracted from Feumba (2015: 7) Data from the Regional Health Delegation of Littoral/Health Management Project, 2010.

**Figure 4: Histogram of household age group distribution in function of water-borne diseases observed in Douala 5.**

According to the IWSC (International Water and Sanitation Centre, 1988) the implication of water in cases of infection is classify as:

- Diseases transmitted by water.
- Diseases related to the absence of water.
- Diseases caused by infectious agents living in water.

Our surveys in some neighbourhood's health centres and in households permit us to list and classified various water-borne diseases (Fig. 3).

- Diseases transmitted by water: These diseases are caused by infectious agents from either poorly washed food or from human beings and animals through drinking water. Among these diseases, the most common observed in Douala 5 are: typhoid fever (23, 60%) age group of 40+, (9, 70%) 15 to 40 years, (13, 90%) from 10 to 15 years, (4, 20%) of age group 5 to 10 years and (22, 20%) from 0 to 5 years. Gastro-enteritis or severe diarrhoea which is dominant (27, 80%) in children from 0 to 5 years, and in adolescent (16, 70%) of 5 to 10 years.
- Diseases related to the absence of water: The lack or absence of a water supply network creates favourable conditions for the development of these pathologies. We identified in this group skin diseases and ulcers recorded under the term "Came no go". These are the most common pathologies in households surveyed (6, 40%) in age group of 0 to 5 years, (4, 20%) from 5 to 10 years, (11, 10%) from 10 to 15, (27, 80%) 15 to 40 and (8, 90%) 40 years above.
- Diseases caused by infectious agents living in water: They require an infectious agent during one of the phases of its vital cycle. They are mainly insects (mosquitoes, flies)

living near streams. Among these diseases, we have malaria (16, 70%) in age group of 0 to 5 years, (15, 30%) 5 to 10 years, (12, 50%) 10 to 15 years, (19, 40%) 15 to 40 years and (8, 30%) from above 40 years.

It is important to note that, unplanned neighbourhoods are the most affected by these diseases. For example, Bepanda, Logpom, Logbessou registered high typhoid cases. According to a study conducted by Nsegbe (2012), these neighbourhoods also experience the highest cases of skin diseases and fecal contamination. Residents of moderate and high standing (Bonamoussadi) are exempted or less affected by water-borne diseases. The spatial distribution of water-borne diseases in Douala 5 shows that, the popular neighbourhoods are the most affected. The populations fetch their water from summarily or unmanaged springs whose waters are subject to various types of pollution. The lack of drinking water in these neighbourhoods to which is added a complete absence of sanitation, is an explanatory factor for the resurgence of diseases, permitting the inequalities in the access to water and more particular potable water.

## Conclusion

Douala 5, an equatorial city endowed with water resources, is nevertheless faced with problems of accessibility to drinking water. Paradoxically, availability is not synonymous with accessibility; topographical and technical barriers, the price of water, leakages and unavoidable water cuts, coupled with the managerial shortcomings of public action, force disadvantaged households to resort to individual and collective solutions such as wells, boreholes and springs, which are sometimes of dubious quality and responsible for a proliferation of waterborne diseases.

SNEC/CAMWATER investment in the city of Douala 5 in order to meet the population's demand for water, did not achieve the expected results. Despite ambitious planning, public management has been deficient. In addition to insufficient investment in the construction and renewal of infrastructure, there is lack of appropriate solutions and technical expertise to ensure the maintenance of the equipment installed. Infrastructure has deteriorated and production has stagnated relatively, leading to the discontinuation of services in many peripheral districts. The diagnosis of the current management of water resources in the city of Douala 5 watershed areas reveals a critical situation arising from a poor planning. In fact, the management of water resources in the Douala catchment area is characterised by multiple gaps and constraint. The failures of services management result in socio-spatial inequalities in access to water. These different impacts are symptomatic of a management problem that raises a central question: What are the concrete responses to be provided in relation to the current state and future urban developments to make this management rational?

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