

Drinking Water in the City of Constantine (Algeria), Service improvement and Transformation of Consumption Habits

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Abstract

This article deals with the problem of the evolution of the drinking water supply service in the city of Constantine, following the application of the new water strategy in Algeria, which is based on the mobilization of new water resources, and the establishment of delegated management of the service. The city of Constantine being as a case study, was able to exceed its deficit, after having benefited from the transfer of water from the Beni-Haroun dam, and management delegated by the company: Société de l'Eau et de l'Assainissement de Constantine (SEACO), in partnership with a foreign operator (SEM, Société de l'Eau de Marseille, France). The balance sheet has improved significantly, allowing a change in the daily supply (24 hours/day). This marked improvement in service has led to changes in consumption habits among the city's inhabitants.

Key words: Constantine city, drinking water, delegated management, consumption habits

INTRODUCTION

The public service of drinking water supply is one of the most important challenges that concern most countries, including Algeria, because this sector is facing many problems: unfavorable natural factors such as limited resources, and other technical, economic, and administrative factors, in addition to the increasing demand for this vital substance. This has placed Algeria in 42nd place [1] among the poorest countries in terms of water potential, below the theoretical threshold of scarcity set by the World Bank to 1000 m³/habitant/year [2].

Faced with this difficult situation, Algeria had to develop its water policy, set up a strategy compatible with its socio-economic component, and structure it around two main axes: the first is the construction and development of hydrographic structures to mobilize more water, and the second concerns the institutional reform of the sector. A new legislative framework has also been put in place to ensure better governance, notably with the enactment of new water law (Law 12-05), which allowed the private sector to contribute to the management of water and sanitation services, especially in the country's large cities, which have already been facing a difficult situation for many years. The management of drinking water in these cities is now entrusted to the public sector in partnership with the private sector, even integrating foreign companies as a new actor in the process.

For decades, Constantine has suffered from quality of water service considered unsatisfactory (poor distribution, persistent interruptions, deterioration in the quality of drinking water, frequent leaks) due mainly to rapid urban growth and changes in the consumption patterns of its inhabitants. Leading to an increase in demand, in the face of already limited water resources, and challenging the management company to meet its water needs and guarantee a quality service. The aim of this paper is to discuss how the drinking water service in the city of Constantine has been improved after having benefited from the dam water of Beni Haroun, and the application of the new management procedures, and we also discuss its impact on the consumption behavior of this important resource among the inhabitants.

MATERIALS AND METHODS

To study the effectiveness of the drinking water service in the city of Constantine, we adopted two approaches; an analytical and comparative descriptive approach to defining the reality of the service and its evolution in time and space.

A survey was distributed and concerned 10% of the number of housing, in three residential area of Constantine: Bab El Kantra, DaksiAbdeslam, and Ben Chargui. Selected according to the type of housing, the actual allocation obtained and the origin of the water distributed, in order to emphasize the quality of the service provided by the ADE and to identify the consumption behavior

Table 1. A sampling of the field survey

Residential area	Bab El Kantra	DaksiAbdeslam	Ben Chargui
Numbre housing	967	3343	1915
Sample of 10%	97	335	192

AREA STUDY

Constantine is an important city in eastern Algeria (Figure 1), marked by its difficult and fragile site (the rock); which has been a real obstacle to its extension. To respond to the problems posed by its accelerated urban growth, the city was spread over unstable land, resulting in irregular and heterogeneous urbanization, with the formation of different planned and anarchic residential areas, and unequal distribution of the population [3].

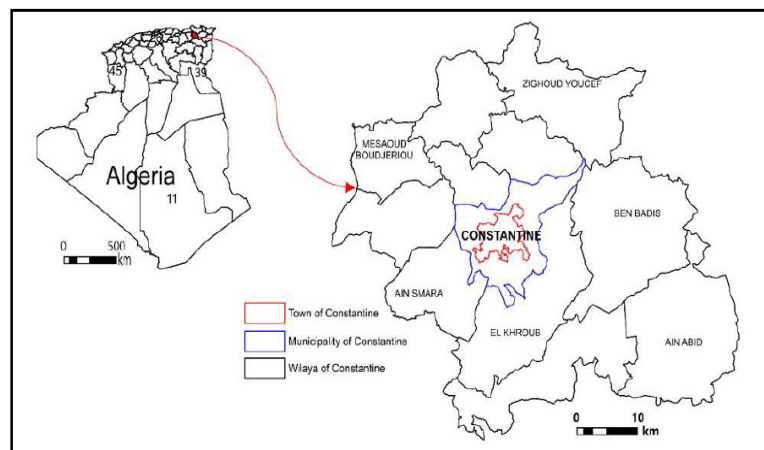


Figure 1. Constantine City: Location

This has made it difficult to meet the increased demand for drinking water services in some areas. The submerged areas of the city extend along the Rhumel and Boumerzouk Oueds which, together with their affluents, have long been the main local sources of drinking water for the city (the Boumerzouk and HammaZawawigroundwater tables) [4], while the average slopes of 5 to 20% are distributed between the different areas with 67.5% (Figure 2). The areas of strongest decline are concentrated along the OuedKebirRhumel to the north of the city [5]. Locally, the differences in altitude, result of a steep site, influence temperatures, and precipitation and give this city a subtropical climate, often hot and dry in summer, and cold and wet in winter [6].

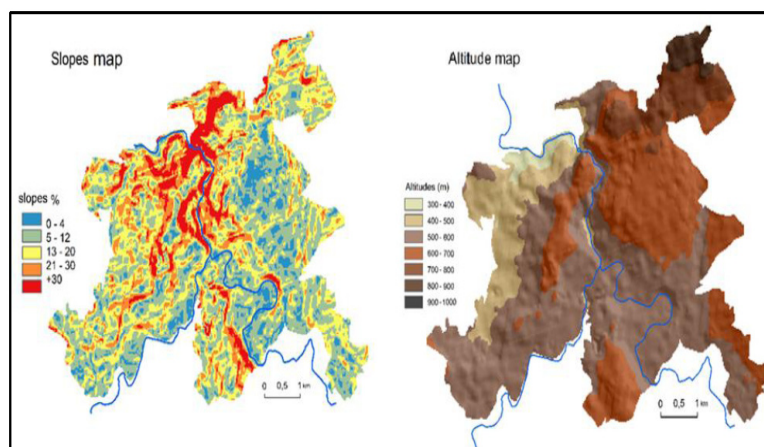


Figure 2. ConstantineCity: Slopes and altitude map (<https://urs.earthdata.nasa.gov>)

Since 2008, the growth rate of the city has dropped to reach (-1.33%), and (-1.01%) in 2010, this is justified by the persistence of the population rehousing program living in slums and precarious residential areas in other bordering urban centers. However, the city has more than 400000 inhabitants in 2017 and has a large housing stock estimated at 42072 houses, distributed heterogeneously in space. In addition, the rate of urbanization has decreased through various statistics, from 98.09% in 1987 to 93.38% in 2008, which indicates a movement of population towards the bordering agglomerations. Nevertheless, the city continues to record the highest demand for drinking water compared to the population of wilaya.

This kind of research requires a distinct spatial division. a different spatial division, based on the hydraulic stage, which is determined according to the slopes (to ensure the distribution of the water by gravity) and its service perimeter; each stage has drinking water distribution tanks located at the highest point in the area. As a result, the city of Constantine was divided into 14 stages (Figure 03); each one of them supplies a group of residential areas.

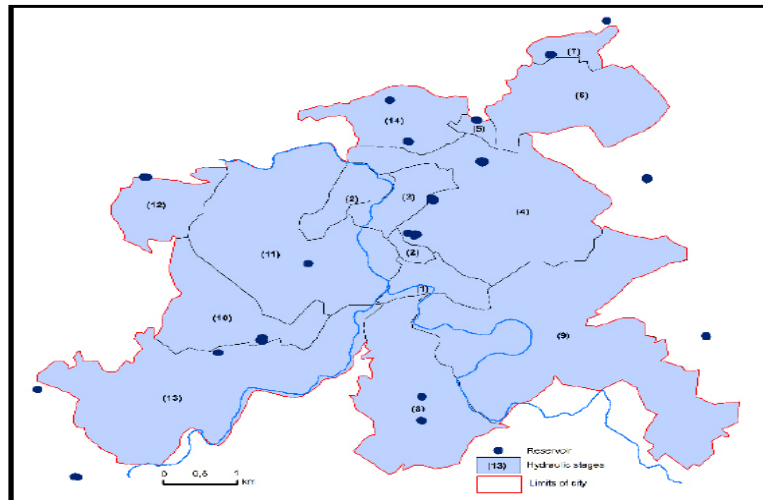


Figure 3. Constantine City hydraulic stages

RESULTS AND DISCUSSIONS

Fresh Water Resources: improved Volumes and Covered Needs

Local water resources are no longer sufficient to cover the fresh water needs of the city of Constantine, which requires access to external sources. By benefiting from the largest water transfer in Algeria (Beni Haroun dam) with a mobilizable volume of 186566 m³, represents 54% of the total quantity destined for the urban grouping of Constantine, which has enabled the city to overcome the deficit it has suffered for so long (Figure 4).

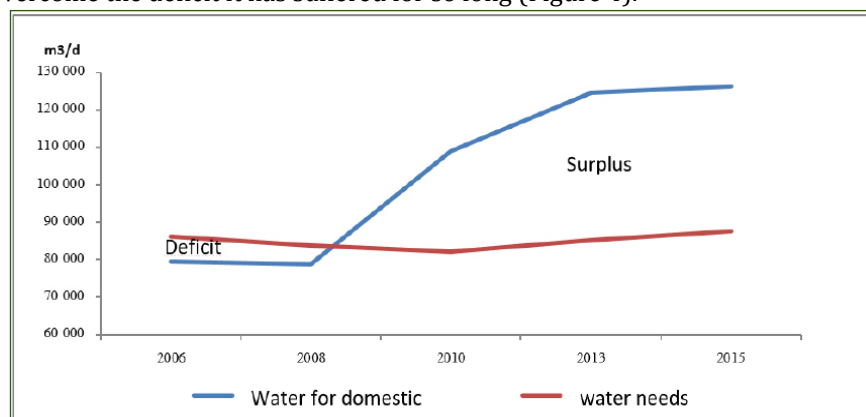


Figure 4. Constantine City; Water balance

The volume of drinking water mobilized for the city increased from 2006 to 2015 by more than 59%, after the commissioning of the transfer of water of Beni Haroun in 2007. Since 2010, the dam of Beni Haroun (with a rate of 68.6%) and Hamma Zawawi borehole (with a rate of 31.2%) have become the only sources used to cover the needs of the city. Some local sources have been gradually eliminated (Boumerzoug source was removed in 2009, and the Hammam Grouz

dam in 2010). This surplus has allowed a significant increase in the supply of water for domestic use, which reflects the residential vocation of Constantine. However, the city's drinking water needs are still related to the population size of each floor (Table 2). The largest volumes, distributed are recorded on the most populated stages(stages9, 4, and 11 account for 52% of the city's needs).

Table 2. Characteristics of hydraulic stages in Constantine City (2017)

stage	Name	Population	water need (m ³ /day)	household water needs (m ³ /day)	Water Endowment (l/d/i)
1	DN 500 from bleach station	26631	5326	3484	131
2	Cheminforesier (02) 3* 2000m ³	27969	5594	2844	102
3	Cheminforesier (03) 2000m ³	11465	2293	784	68
4	Camp-fray 4*2000 m ³	75101	15020	13368	178
5	Halbedel 2*1000 m ³	7766	1553	629	81
6	Ziadia 2*2000 m ³	28811	5762	3642	126
7	Djebel El Ouach 2000 m ³	7850	1570	770	98
8	from bleach station 240 + 2000m ³	10041	2008	1912	190
9	El amass + reservoir 50000 m ³	86977	17395	11172	128
10	Touifes	34694	6939	7585	219
11	Belle vue	66711	13342	11290	169
12	Ben chergui 1000 m ³	17841	3568	2057	115
13	Grouz	21286	4257	2343	110
14	SidiM'Cid 2000 m ³	14434	2887	2733	189
Total		437576	87515	82513	189

Source data: ONS Constantine, DREW, ADE, (In Bouldjemar2020).

This increase in the volume of domestic water has led to a significant improvement in the average daily endowment of drinking water per person, from 66 l/d/inhabitants in 1999 to 189 l/d/inhabitants in 2017. This allocation varies from one hydraulic stage to another depending on the specificities of their residential area; Where the highest endowments (132 -219 l/d/inhabitants) are recorded in the planned residential areas of the recent creation (date to the 80s and 90s), characterized by distribution networks with less technical problems and leaks. On the other hand, in spontaneous districts and old districts such as the old town (the Medina), the endowment decreases to reach 68 l/d/inhabitants. This reduction is due to the obsolescence of the old distribution network, which dates back more than 70 years, as well as other technical problems such as illegal connections, repeated leaks, and insufficient diameter (Figures 5&6).



Figure 5. Illegal connection to a drinking water network –Stage 12 (Field Investigation, 2017)

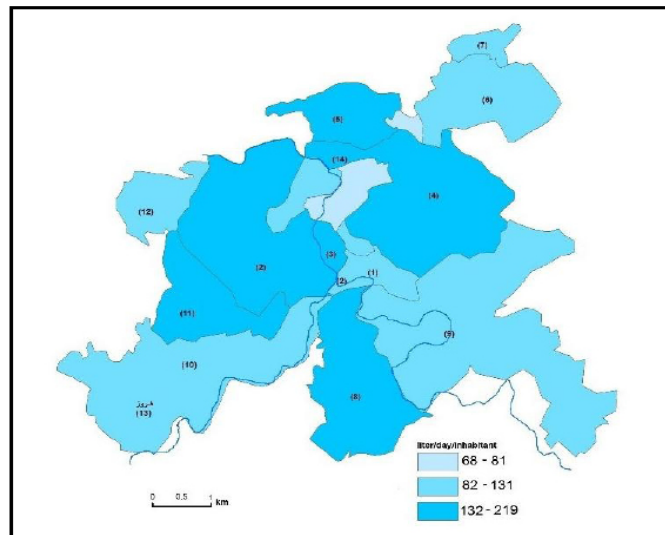


Figure 6. Constantine City; Endowment per hydraulic stage(l/d/i)

Delegated Management of the Drinking Water Service

In Constantine, the water service remained under the supervision of local authorities or public establishments, which systematically carried out reforms during different periods: after having been progressively withdrawn from local authorities for lack of efficiency and means, the public companies alone retain the right to manage the water service. Since year 2000, in order to implement the major reforms in the water sector, the State has entrusted the management of water services to a national company bringing together all the water management companies in the country, trying to crack the European model of “Lyonnaise des Eaux - France”. This gave birth to the ADE(Algérienne Des Eaux)[7]. In March 2008, it delegated the management of the service to SEACO, created following the grouping of two operators (Table 3): the ADE and the ONA (Office NationaleD’assainissement) in order to ensure the public service management of water and sanitation of the 12 municipalities of the wilaya of Constantine. [8].

Table 3. Chronology of the management and water service of Constantine

Period	The managing institution	Management type
1962-1969	The municipality is represented by its own services based on: - Distribution of drinking water - Wastewater drainage and treatment	direct management
		municipal authority
1970-1983	- Fondationof Société Nationale de Distribution d’Eau Potable et Eaux Industrielles (SONADE), (By Order No. 70-82 of December 23, 1970) - Municipal	- Management delegated to grant concessions to the public establishment
		- Municipal
1983-2002	Creation of the water supply, management and distribution company in Constantine (EPECO) (1983). A regional company which operates in the wilayas of Constantine, Oum El Bouaghi and Khenchela, then its regional jurisdiction is modified and includes Constantine, Jijel and Mila in 1987	- Management delegated to grant concessions to the public establishment (EPECO)
		- Municipal
2002-2006	Dissolution of EPECO (2002) replaced by ADE and ONA. The role of the commune was limited to managing the water service in the rural communes.	- Management delegated to grant concessions to the public establishment (ADE & ONA)
		- Municipal
2006-2008	The creation of SPA-SEACO following the merger of (A.D.E) and (O.N.A)	For delegation with SEACO Municipal Authority

2008-2014	SEACO in partnership with SEM.	For delegation with SEACO and SEM
After 2014	SEACO receives the water service throughout the territory of the wilaya after the expiration of the partnership with the SEM	For delegation with SEACO

In order to meet these challenges and to make the service effective in a record circumstance, a partnership with an international enterprise has been requested to pilot this project, which is based on a mixed management between SEACO and SEM companies with a workforce of approximately 1200 employees, and a funding of 72.8 million euros [9]. The objective is to develop a strategy based on a better knowledge of the population to be served in order to better identify the volumes of water to be distributed, the modernization of service management, and the development of society through the transfer of experience and technology.

In 2014, and after the expiry of the partnership with SEM, the management of water and sanitation services throughout the territory of wilaya is returned to SEACO [10]. The application of equitable economic pricing for the use of water in Algeria, allows solidarity with disadvantaged groups and converges with the costs of the service, is an urgent imperative, on the one hand, and to reduce the rates of water consumption, on the other hand. In order to increase the revenues of the managing company and contributes, subsequently, to the continuity and improvement of the service provided.

Currently, the city of Constantine benefits from a continuous distribution (24/24 hours) of water (Figure 7) according to quality standards, with the exception of stages 6 and 7, which are supplied, due to technical difficulties, only a few hours a day. However, the problem of leaks on the distribution network, especially in the spontaneous residential area and the old town (the Medina), remains the main obstacle that SEACO still fails to overcome.

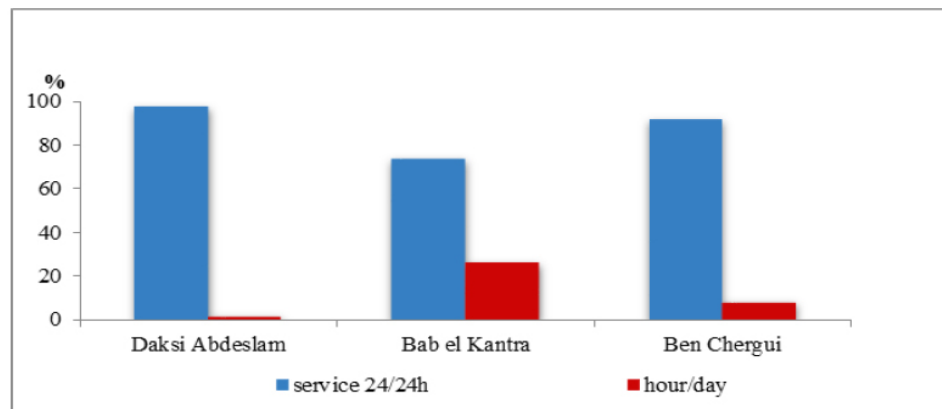


Figure 7. Distribution service (Field Investigation, 2017)

The Development of New Water Consumption Habits

The improvement of the drinking water service in Constantine had an impact on the daily life of the inhabitants. The presence of running water in their taps has inevitably led to a change in their consumption habits, which will be analyzed according to the economic situation of households, the occupancy rate per dwelling, and the types of internal hydraulic equipment.

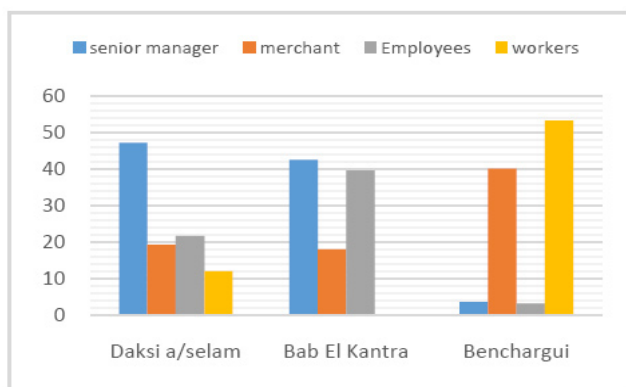


Figure 8. The Proportion of professional groups in the study samples

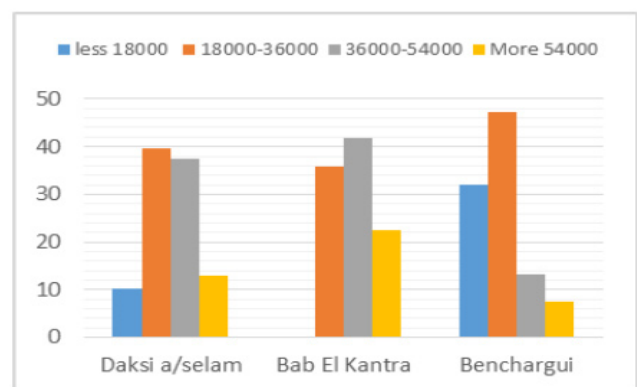


Figure 9. Percentage of average household income in study samples

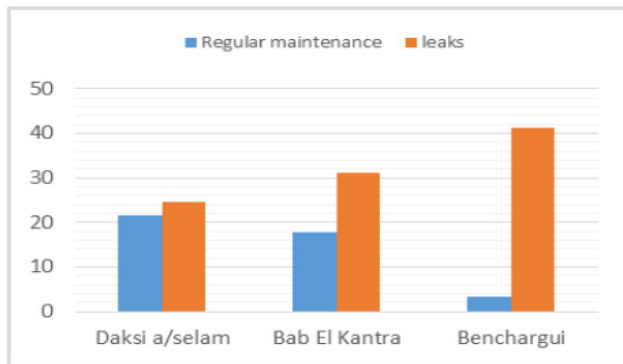


Figure 10. The percentage of maintenance and the prevalence of leaks in the study samples

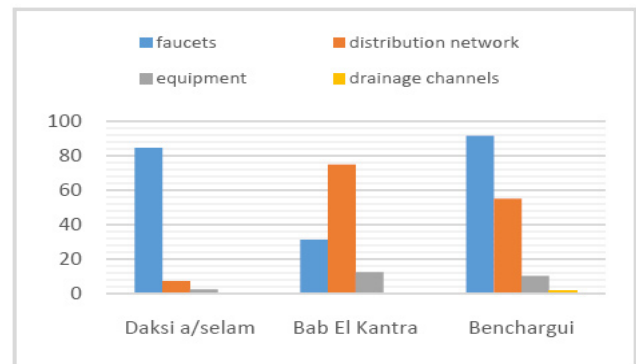


Figure 11. Type of leaks inside the house

There is an inconsistency in the distribution of occupational groups according to the samples studied (Figure 8), where the two categories of managers and employees predominated in each of the following residential areas: DaksiAbdeslam, Bab EL-Kantara. In the district of Ben Chargui, the working class is dominant, with the emergence of the category of small traders. High- and middle-income families appear in most residential area (DaksiAbdeslam, Bab EL-Kantara), while the low-income group spreads into the precarious Ben Chargui residential area (Figure 9). This disparity in occupations and incomes will inevitably have an impact on the quality of housing and equipment in terms of the hydraulic facilities needed to achieve daily well-being. The collective houses of DaksiAbdeslam, Bab EL-Kantara, are generally single-family houses, with an occupancy rate of between four and six persons per house. Nevertheless, the Ben Chargui district is known for its multiplicity of households and its high occupancy rate per house. Consequently, the increase in the occupancy rate of persons per dwelling will automatically reduce the daily supply of drinking water per person and thus increase the volume of water consumed by households living in the same habitation, which are connected by a common meter.

Basic hydraulic equipment (taps, bathtubs, and toilets) are available in every housing and have become indicators that clearly reflect the change in consumption habits among the population and the well-being achieved in their daily lives. In addition, other hydraulic devices, such as washing machines and water heating, have become more than necessary and available in almost all households, of which 96.8% of the inhabitants declared to have these devices. On the ground, we also observed the omnipresence of reservoirs installed above the houses (individual and collective). However, residents say they use them when the water supply is interrupted, while others have eliminated them.

In addition to this perceived comfort, most inhabitants neglect the maintenance of their distribution network and internal hydraulic equipment (Figure 10) in order to avoid the appearance of leaks, because only 23% of them carry out maintenance; this led to leaks in the valves and distribution systems. Most of these leaks have spread mainly to spontaneous residential area, such as Ben Chargui (Figure 11), often justified by lack of income.

CONCLUSION

The availability of water has led to a diversification of its use and a transformation of consumption behavior among the population of the city. The increase in the volume of mobilizable water, as well as the delegation of services to SEACO in partnership with a foreign operator, have made it possible to effectively improve management methods, which have had a positive impact on the daily life of the inhabitants thanks to a continuous distribution of 24 hours/day, the increase in the actual supply of drinking water per inhabitants per day. This improvement has also had a negative impact on their drinking water consumption habits, which are already dominated by waste rather than rationing consumption by the different social categories of the population. However, the leak on the distribution network remains the main obstacle to improving the drinking water service in Constantine.

REFERENCES

1. Arab Report on Human Development (2009): Challenges to Human Security in Arab Countries", p. 38;
2. CNES (2000): Water in Algeria (2000): the great challenge of tomorrow. Report of the National Economic and Social Council; 15th session;
3. Master Planning and Development Plan (PDAU) GUC 2008.

4. MEBARKI. Azzeddine, (1991): Water supply of the Constantine agglomeration (Algeria): Resource balance - needs and development prospects. Tours, URBAMA, water and the city, Fasc no. 22, pp.173-187;
5. BOUSSETTI Sandra, MEBARKI Azzeddine (2019): The supply of drinking water in the urban group of Constantine, Science & Technology D - N°49- University of Constantine 1.
6. ANSER Allaoua (2019): The climate of Constantine, Office de Publication Universitaire, Alger
7. Bouldjemar Lamia (2020): Role of Water Services in Improving Living Conditions in the Urban Group of Constantine, PhD thesis in Spatial Planning (Université de Constantine 1);
8. BITAT Belkacem (2013): Water management in a situation of shortage, the case of Tamanrasset (Sahara central), thesis in geography, Aix Marseille University.
9. GHACHI Azzeddine (2013): Urban Water in Algeria, Science & Technology D - N°37, June. Université de Constantine 1, Algérie.
10. Bouldjemar Lamia (2017): Drinking water distribution service in large urban agglomerations in Algeria; Transformation in the management and activation of the service: the case of the urban assembly of Constantine. Science and Technology D, Number 46 December (2017). Université de Constantine 1.
11. <https://urs.earthdata.nasa.gov>

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