

## RESEARCH ARTICLE

## OPEN ACCESS

**Drinking Water in Guwahati City: Its Past, Present Status and Associated Problems**Dr Prasanta Bhattacharya<sup>†</sup> and Rajashree Borah<sup>‡</sup>**Abstract**

Guwahati is one of the fastest growing cities of Northeast India. The haphazard growth of the city has resulted in a chaotic situation, giving rise to circumstances not favourable to its residents in many aspects. Amongst these, drinking water is the most crucial problem confronting the residents. In this paper, an attempt has been made to assess the availability of drinking water over a period of time in the city. In addition, it also attempts to understand the challenges of drinking water availability at present. Apart from consultation of secondary sources like archival data, local municipality body, primary data has been collected from three selected municipality wards based on their core, periphery and midpoint locations among the 60 wards of the city.

**Key words:** drinking water, availability, Guwahati, Assam

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## Introduction

Throughout history, civilisations have thrived in regions of abundant availability of water resources. Historical evidence shows that during the Roman civilisation, issues like purity of water, turbidity, groundwater, slope of aqueducts, pipes, wells, etc. were points of discourse of the urban water supply systems (Biswas, 1985). History further tells us that in many kingdoms man-made ponds were dug out to serve the needs of water. Even in Assam too, the Ahom kings (1228-1826) dug out ponds, especially in eastern and central Assam, which served the purpose of drinking water and water for ritualistic purposes. Care was taken to maintain the hygienic aspects of water in such lakes and ponds. Apart from it, 'wet point' locations of the villages or townships on the bank of rivers/streams also served the need of drinking water along with a navigable medium for movement of men and materials. However, with increased population and associated pressure on resources led to over-exploitation of water resources and water scarcity, which have become a nightmare to a huge section of population all over the globe, more specially in the developing countries (Borah, 2013). In similar context, the all-India scenario of drinking water supply continues to be deficient (Ghosh Mitra, 2010; Mckenzie and Ray, 2005; 2009; Vishwanath, 2013).<sup>1</sup> "No Indian city receives piped water 24 hours a day, 7 days a week."<sup>2</sup> According to WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply

and Sanitation, in 2011, 92 per cent of the total population of India had access to improved source of water (96%-urban/89%-rural).<sup>3</sup> However, the water supply systems in most cities of India are poorly operated with weak infrastructure and poor resource management (Ananthkrishnan, 2007; Ghosh Mitra, 2010; Mckenzie and Ray, 2005; 2009; Vishwanath, 2013) and the city of Guwahati is no exception (Borah, 2013).

Guwahati, the capital city of Assam, is located on the crescent-shaped south bank of the river Brahmaputra, in the Kamrup Metropolitan District (Fig 1). The foothills of the Shillong plateau lies to its south, with LGB International Airport to the west and town of Narengi to the east. The core of the city is surrounded by hillocks of varying altitude between 100 to 300 meters. The average altitude of the city is 54 meters from the mean sea level. The city extends from 26.5°N to 26.12° N latitude and 91.24°E to 91.51°E longitude. The stretch of the river Brahmaputra within the city area is 12.78 km. The river has been satisfying the basic needs of the people being the only major source of water, mode of riverine transportation and add-on scenic constituents. Guwahati city experiences mild subtropical climate. The average rainfall at Guwahati is 2272.37 mm and about 90 per cent of it occurs between May and September. In the following section, we draw a brief background on the drinking water availability in Guwahati.

<sup>1</sup> India: Improving Urban Water Supply and Sanitation Service Provision Lessons from Business Plans for Maharashtra, Rajasthan, Haryana and International Good Practices, 2012, The World Bank and Ministry of Urban Development, Government of India, available at: [http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/07/13/000333037\\_20120713000816/Rendered/PDF/709010ESW0v10POC00WSS0Report0Final.pdf](http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/07/13/000333037_20120713000816/Rendered/PDF/709010ESW0v10POC00WSS0Report0Final.pdf) (accessed on 12 December 2013)

<sup>2</sup> Urban Water Supply in India (4 July 2011). *The World Bank*, available at: <http://www.worldbank.org/en/news/feature/2011/09/22/urban-water-supply-india> (accessed December 12 2013)

<sup>3</sup> WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation, WHO/UNICEF, available at: <http://www.wssinfo.org/data-estimates/table/> (accessed on 13 December 2013)

**Brief Background**

In Assam, availability of drinking water began to hit the people hard more specially in the urban areas due to rapid increase of population and

unreliable nature of public water supply in most cities (Ananthkrishnan, 2007; Ghosh Mitra, 2010; Mckenzie and Ray, 2005; 2009; Vishwanath, 2013) including Guwahati, people

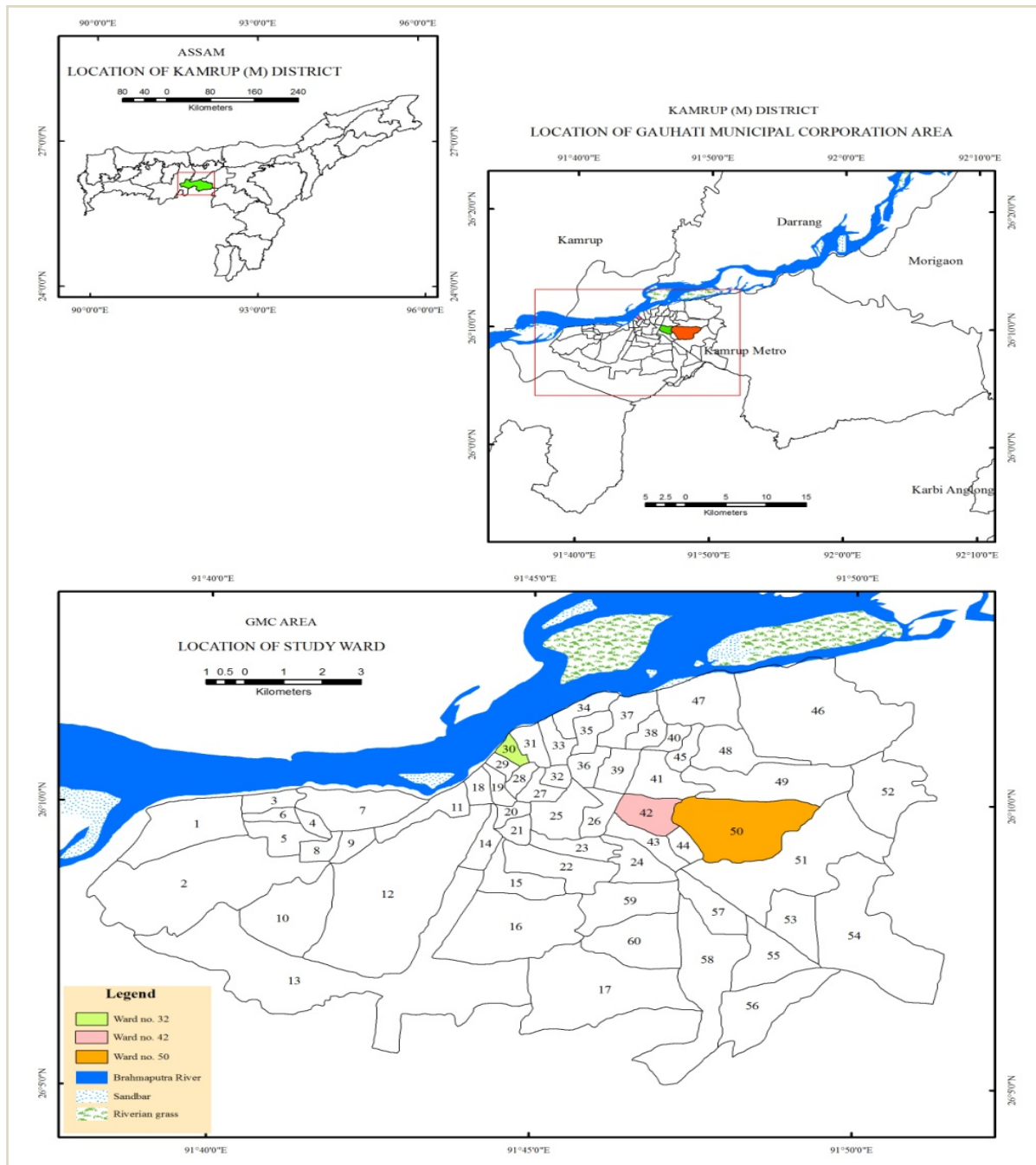


Figure 1: Location of the Study Area (Courtesy of the Authors)

unplanned development of urban areas (Devi, 1998). After India’s independence in 1947, the Public Health Engineering Department (PHED) was established in 1956 by the government of Assam to fulfil the requirement of drinking water. This department was entrusted with the responsibility of providing safe drinking water (Bakshi and Roy, 2010). However, due to

have to depend either on their own sources, or on some commercial agencies and (or) on water vendors, which is in fact not possible for all the dwellers on a regular basis. Therefore, these areas need immediate attention to understand the issues relevant to drinking water and the scarcity of safe drinking water in

the city environment along with understanding the problem in spatio-temporal dimension.

This research attempts to understand the availability of drinking water for the city, based on secondary database from relevant government agencies. However, primary data on issues associated with drinking water availability has been generated from three selected wards targeted for the study. These three wards represent the core, the peripheries and the intermediate locations of the city. Ward No. 30 falls on the core of the city area, where the main water supply plant is located. An intermediate location of the city is selected through the Ward No. 50, where a water treatment plant is located at Hengrabari. A peripheral ward, No. 42, is also selected for the purpose, based on the investigator's personal acquaintance with the problems of the area. The primary investigation tries to highlight issues regarding availability of potable water, its proper use and management, as well as identification of problems pertaining to drinking water.

### **Objectives and Methodology**

Evaluation of the availability of drinking water in the city environment of Guwahati continues to be the main objective of this research—the specific objectives are:

- To evaluate the public water supply provisions in the city environment,
- To identify the present sources and availability of drinking water amongst the city residents, and
- To identify the present problems related to drinking water in the city.

For attaining the objectives, the research follows an exploratory as well as explanatory approach based on the analysis and interpretation of both primary and secondary data. Both empirical and descriptive method has been sought for the purpose. While the empirical method focuses on obtaining findings numerically from primary data and use of descriptive statistics, the interview of the authorities associated with water supply,

perception study of the resident community and evaluation of urban water generation mechanism through archival record also provide a space for using qualitative as well as descriptive method in the study.

The data has been collected in sequential stages. In the first stage, secondary data has been collected from the official records, annual records of the office of Guwahati Municipal Corporation (GMC) along with State Archive to gather historical records relevant to the problem. E-publications and websites are also browsed in the process to gather relevant information. In the second stage, primary data has been collected by conducting field surveys based on purposively designed questionnaire targeting the user segment of water. Household survey was conducted to assess the status of available drinking water, their sources, gaps between demand and supply and relevant data pertaining to the topic. Random sampling method is adopted for data collection at household level. Since the area is heterogeneous in terms of socio-economic status of the resident community, this technique is used so that each household has an equal opportunity to be a part of the representative sample. Personal interviews constituted one of the most important and valuable sources of information. Such interactions helped in examining the social reality and understanding what is significant and important aspect of the problem from their perspective. Altogether 324 households have been covered in the survey (Table 1). Samples have been collected according to the population size of the respective wards and considering diverse economic background to produce a more accurate picture regarding the availability of water among different segments of the society. In the second stage of primary data collection, a survey of the public water supply plants and commercial agencies or private suppliers was conducted, in order to capture the idea of water availability from suppliers' point of view. This was done based on questionnaire and personal interviews with persons responsible for the management of the water supply plants.

## Analysis

### Water Availability in the Pre and Post-Independence Era

The development of public water supply system in an area bears a long history. It is also often the result of requirement and reflection of a

social aspiration of communities in the concerned areas. Although, there were not any well-planned public supply systems in Guwahati in the historic past, however, a few big tanks: Digholi *pukhuri* (tank), Zor (pair) *pukhuri* in Ujanbazar and Nak-kota *pukhuri* in Panbazar along with Kamala Kuwari *pukhuri* in Chandmari reflected the aspiration of Ahom rulers for ensuring the availability of drinking water for the then resident community of the area. There was also prevalence of small water tanks and wells excavated at various localities to collect water. Besides these wells and tanks, the river Brahmaputra and the river Bharalu (a small river passing through the city) also served as a source of water for the people in the city.

The study of archival data on the drinking water sources of the area reveals that different sources like concrete ring well, stone well, Rane Ganj pipe well, Borpeta ring well and tanks served the needs of the people during the pre-Independence era. In the past, Barpeta ring well was extensively used. The rings of the well were made with soft mud and its construction cost was ₹ 50. As the construction procedures were prevalent at Barpeta and rings were made in that locality, this type of ring well was commonly referred to as 'Barpeta ring well'. This type of well still exists in remote areas of Barpeta. The construction and maintenances of such wells in the city was under the municipality board. A register was maintained by the board for any new well constructions or excavation of public tanks for water supply. People from the higher section of the society, railway buildings and other high administrative authorities had their own sources of drinking water and did not rely on the public sources.

Since 1911, water tax was liable in the town of Guwahati, irrespective of the usage of water supplied. It was fixed at the rate of ₹ 83

quarterly, per household (State Archive, Local Self Govt, June 1925, file No.336). However, the charge was not according to the consumption.

Extreme scarcity of drinking water existed even during that period and quality of water was very poor. There were instances of widespread water borne diseases like Cholera and Kala-Ajar. In 1938, many typhoid cases were registered from the towns and rural areas of Kamrup District (State Archive: Local Self Govt., September 1938, file No.231-234). Higher number of deaths was registered from towns because the causes of death were more correctly classified and recorded than the villages. Such deaths were brought about by the perennial contamination of water supplies. People were ignorant of the contagious nature as well as the agents of contaminations (State Archive: Public Health, B, June 1938, File nos. 529-530). Many wells, which were constructed, had no provision against contamination— infections often rolled over from the neighbourhood or even from the dipping of

**Table 1: Sample Size of the Study**

War d No.	Popula- tion	No. of House- holds	No. of Sample per House- holds	% of Sam- ple
30	7564	1350	72	5
42	12181	3013	144	5
50	10933	2732	108	4

**Source: Population Data based on Census of India, 2001**

dirty and infected private buckets. The concerned authorities took the task of disinfecting the wells only when Cholera or other contagious diseases broke out in the form of an epidemic.

Although the tanks and wells were excavated at various places but the numbers were very few and could no longer meet the demands of water and many a times the water was so dirty and contaminated that it was no more fit for human consumption. Owing to the extreme scarcity of water, all the prevailing tanks and wells were used, but from the sanitary point of view, at least 30 per cent of the tanks and wells were quite unsafe for human consumption (Table 2). According to a report prepared by Guwahati Local Board in 1924, at least 200

tanks and wells were required to be constructed with properly sloped platforms without any delay to provide drinking water to the people who urgently required it and to save the people from diseases like typhoid and cholera.

**Table 2: Number of Tanks and Wells in Guwahati during 1924-1925**

Source of water	No. of Tanks and Wells
Number of tanks	109
Number of wells	37
Number of tanks fit for use	76
Number of wells fit for use	26

**Source: State Archive, Gauhati Local Board, 1924-25**

However, owing to the lack of funds no such programmes or schemes were undertaken. The only way to tackle the water supply problem was to ask the government for an adequate grant. A yearly contribution of at least ₹ 3000 was required. Simultaneously, Guwahati Local Board was supposed to pay an equal amount of money every year towards the construction of wells; however, it was handicapped by the government's massive cuts on water supply grants. In the absence of any assurance from the government, the board could not make an extensive scheme, but together with limited funding and voluntary contributions from the residents, who contributed one-third of the required cash, it constructed as many wells as possible.

After the declaration of Municipal Body in 1873, the first water treatment plant was constructed in Guwahati in 1887 at Panbazar. Later, the Municipal Body was renamed as Guwahati Municipal Corporation (GMC). The first modern water treatment plant under GMC was established in 1960 at the initial Panbazar site which is still functioning. Later on, two public water supply systems were established at Satpukhuri, Ujan Bazar (1984) and Kamakhya (1992). In the beginning, there was only one public water supply system to meet the needs of drinking water in the city. Although, the development of a water plant initially fulfilled the demand of the residents, other operating system like community water tanks or reservoirs were also placed according to the

population density at core localities of the city. Some people have their own dug wells. Moreover, public wells were also constructed by the GMC from which people used to collect water. From the water plants, drinking water was supplied to households through pipelines and mobile tankers. Later, Assam Urban Water Supply and Sewerage Board (AUWSSB) were also constituted in 1996 to cater the demand for drinking water in the area.

### **Present Status of Water Supply**

The drinking water needs of the majority of the population in the study area are at present fulfilled by the municipality through piped supply or water supplying tankers. However, the quantum of supplied water is quite limited and irregular and there is a mismatch between demand and supply. The local residents need to face the worst situation, especially during the dry winter season in the city. Under such circumstances, many private initiatives have also come up to cater to the ever-increasing demand of water for the growing population of the city. Although, these supply agencies fulfil the demand to a great extent but most of them operate illegally. Over-exploitation of ground water by such agencies caused public resentments in some localities of the city. Under such circumstances, reliance on ground water should be minimised by giving emphasis on the use of the river Brahmaputra as the main source of drinking water. Moreover, rainwater harvesting may also be encouraged among city residents to face the challenge of water deficiency.

Nonetheless, the GMC has been playing a very important role by supplying drinking water for the people of the city. The main source of water for their three water-treatment plants is the river Brahmaputra. However, GMC also has ground water as its source for some areas. For this purpose, it dug 20 deep tube wells scattered all over the city. From these tube wells, water is supplied directly to the consumers in and around the location of the respective wells. According to 2012 statistics, water supply from the plants under the GMC served approximately 30,000 households. It has

a total supply capacity of 430 million litres per day. Out of the 60 city wards, altogether 27 wards are covered under these plants and some wards are partly covered. Thus, it has been able to meet the demands of drinking water only up to a very limited extent (Table 3 and Figure 2). As the installation capacities of the plants are meagre, it can only cover approximately 30 per cent of the total population of the city (GMC, 2012); the provisional population total of Guwahati city according to 2011 Census of India is 963,429.<sup>1</sup>

Although, the Panbazar water-supply plant continues to be the most important in relation to the supply of drinking water for the entire city, it has serious defects in many areas of its management as well as infrastructure. Nothing much has been done by the government for the development of the plant. The installation capacity is far below its actual requirement and therefore, it has been able to serve only 30 per cent of the total population. The quantity of water supplied to per household each day is very limited. It has also been facing shortage of manpower due to non-recruitment. For power supply, the plant has to depend upon the Assam State Electricity Board for all its operations due to the absence of its own source of power or any such backup. In such situations, long and frequent power cuts make all the operations of the plant come to a halt resulting in intermittent water supply.

Moreover, at the time of floods, especially during the summer seasons, polluted water enters through the leakages of the old pipes and fittings and consumers are often supplied with such polluted water. Replacements of the pipelines have rarely been made.

To meet the need of water, three new water supply schemes have already been undertaken by the state Government for the entire Guwahati city. For this purpose, the whole city has been divided into three parts, that is, eastern, central and western Guwahati. The

management and operation of each area will be under three different agencies, that is, JICA (Japan International Cooperative Agency), ADB (Asian Development Bank) and JnNURM (Jawaharlal Nehru National Urban Renewal mission). So far, 80 per cent works of these projects have been completed. At present, laying of pipelines is going on in the city. It is expected that the project will be operational by 2015 (Table 4). The existing drinking water supply departments will come under single authority and all the present operating plants will be closed down. It is anticipated that such development may provide major relief for the Guwahatians as they are expected to provide 24x7 pre-paid metered water supply. However, public resentment regarding the commercialisation of civic amenities like drinking water has also been in the city, expressed through different forum of civil societies.

#### **Status of Public Water Supply Provisions in Selected Wards**

The public water supply system of the selected wards (30, 42 and 50) depend both on water from the river Brahmaputra as well as on ground water. Overall, 69 per cent households of these wards have surface water as their main source and 31 per cent depend on groundwater. Households that have both surface and groundwater consist of 27 per cent. Drinking water supplies in the study area are under the management of two different authorities—GMC and AUWSSB (Assam Urban Water Supply and Sewerage Board) (Table 5).

The field investigation reveals that out of the total of 324 households covered by our survey, 225 households have municipality-supplied water as the major source of drinking water—58 households out of 72 (in ward 30), 110 out of 144 (in ward 42), and 57 out of 108 (in ward No. 50), avail public water supply connections.

<sup>1</sup> Guwahati City Census 2011 data, Population Census 2011, available at: <http://www.census2011.co.in/census/city/191-guwahati.html> (accessed 30 December 2013)

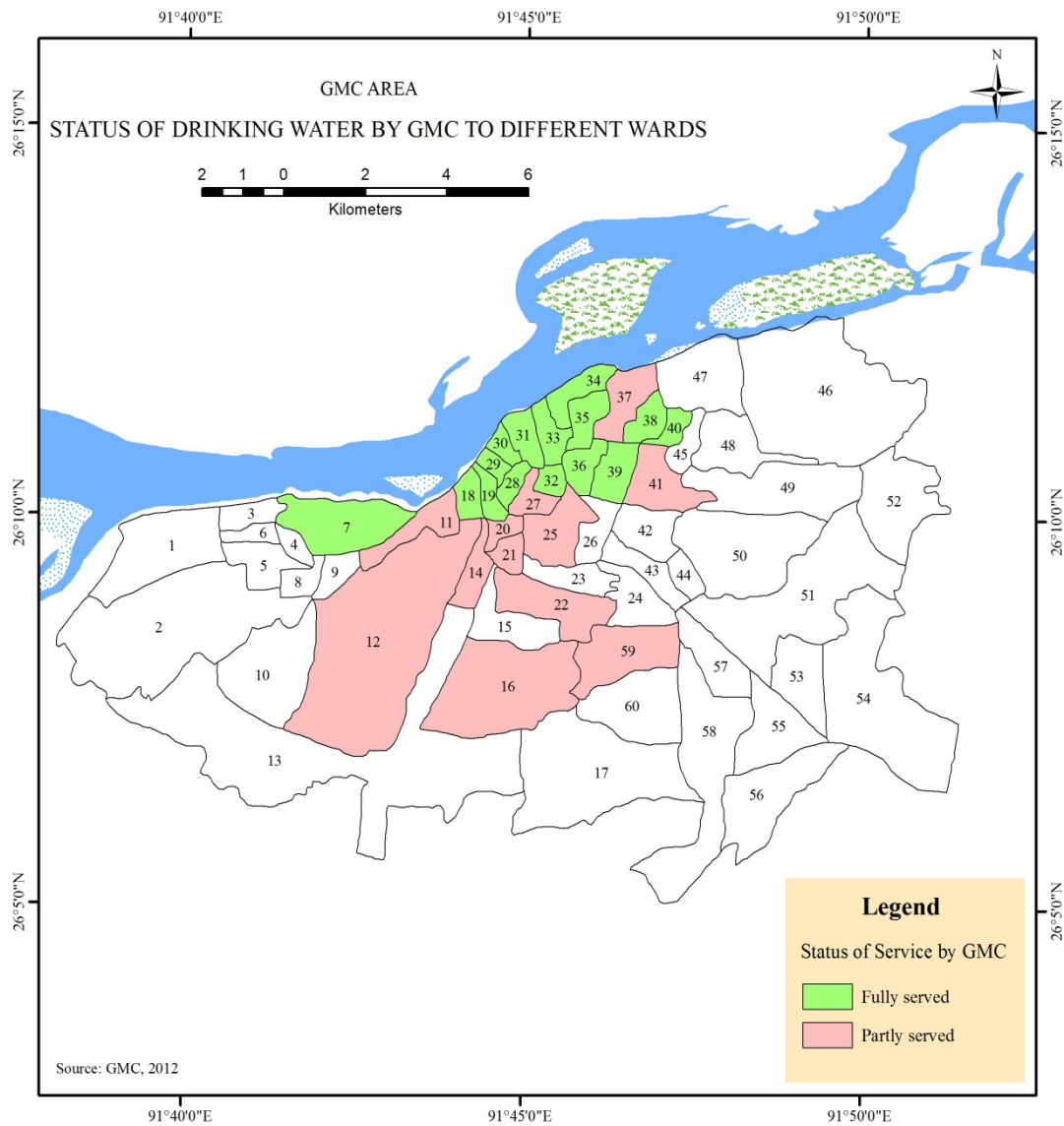


Figure 2: City Wards served by GMC, 2012 (Courtesy of the Authors)

**Table 3: Wards Served by GMC, 2012**

Status of service	Ward No.
Fully served	7 18 19 28 29 30 31 32 33 34 35 36 38 39 40
Partly served	11 12 14 16 20 21 22 25 27 37 41 59 - - -

Source: GMC, 2012

**Table 4: Areas to be Served by the Proposed Projects**

Area	Agency
East Guwahati	ADB
Central Guwahati	JICA
West Guwahati	JnNURM

Source: GMC, 2012

**Table 5: Authority Responsible for the Supply of Drinking Water**

Ward No.	Authority
30	GMC
42	AUWSSB
50	AUWSSB

Source: GMC, 2012

**Regularity and Frequency of Supply**

Interestingly, our survey reveals that there is a vast difference among the three wards in terms of regularity and supply of drinking water (Table 6). During the monsoon season, water supply condition stays fairly. However, during the dry season (September to March) the frequency of supply becomes highly intermittent. Thus during the dry season in ward no. 42, 96 per cent of the households face the problem of highly irregular water supply. Similarly, in ward No. 30, the share of irregularity is around 40

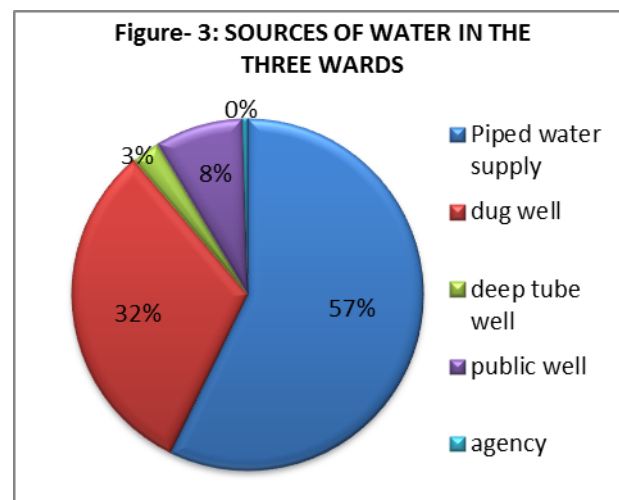


per cent and in ward No. 50, it is around 33 per cent. Among the wards, supply scenario is comparatively impressive in ward number 30, as the Panbazar water-treatment plant of GMC is located in this ward. In terms of frequency of supply, it is limited to just one time per day and supply duration ranges from two to four hours.

Generally, water and sanitation projects experience their most serious problems with operation and maintenance and with cost recovery aspects due to which the consumers have to face the problem (Biswas, 1979). In this said context, the water supply system operating under the two different authorities of the city too have faced this problem and runs in a chaotic situation without any proper management. Therefore, it is imperative for these authorities to plan for smooth operation and maintenance, in order to ensure sustainability of all the water supply plants of the city, at least until the new water supply project, which is currently undergoing construction, comes into operation.

### Sources of Drinking Water

While conducting any studies on water, it is essential to identify the source of drinking water available for the users. The study showed that the need of water is fulfilled by different sources according to the affordability and conveniences of the users. The major sources of drinking water in the study area are municipality water through piped water supply (57%), individually dug wells (32%), deep tube wells (3%) and 8% public wells (Figure 3 and Table 7). However, for a certain section of people (especially in ward No. 42), the only source of drinking water is the commercial water supplying agencies.



The data regarding the sources of water reflects that the municipality water is the primary source in ward no. 30, which covers 77 per cent of the households. As the city's main public water, distribution system is located in this ward, therefore, availability and reliance on public water system is found to be more here. However, 20 per cent of the households rely on individually owned wells and 3 per cent depends on deep tube wells. Nevertheless, as one move from the city core to the intermediate zones of Guwahati, reliance on public water system is found to decrease. In the wards no. 42 and 50, piped water supports 40 and 39 per cent of the households respectively. Apart from it, wells meet the need of 20 per cent households in ward no. 42, followed by deep tube well (3 per cent), private agency (2 per cent), etc. In ward no. 50, share of piped water reduced to 39 per cent of households and share of public wells (29 per cent) are found to be an important source of water. Among the wards, share of deep tube well as a source of water is found to be limited, as it involves more cost and generally beyond affordable limit of a middleclass family. Apart from it, these wells are also found to be responsible for over-exploitation and consequent ground water reduction in respective localities.

In ward no. 50, the percentage of households having piped water supply is 39. In this ward, the water is supplied by the Hengrabari water plant, which is under the authority of AUWSSB. It is seen that another major source of drinking water for this ward is public wells, which serves about 29 per cent of households. These wells

have come to play a very crucial role on meeting the demands of drinking water in the absence of a proper reliable public water supply system. Another reason for the dependence on public wells is due to the high cost involved in taking a new water supply connection. Besides these, the area is hilly and many households living in the upper slopes do

not have any connections of piped water supply. Even the households having piped water supply connection, the quantity of supplied water is very less. Around 19 per cent households of the area are having individual wells as supply water fails to fulfil their demand.

**Table 6: Regularity of Municipality Water Supply**

Ward No.	Monsoon season		Dry season	
	Regular (No. and % of Households)	Irregular (No. and % of Households)	Regular (No. and % of Households)	Irregular (No. and % of Households)
30	58/99	-	35/60	23/40
42	108/98	1/0.9	4/3	105/96
50	57/99	-	48/56	19/33

Source: Field survey, 2012

**Table 7: Ward-wise Sources of Drinking Water, 2012**

Ward	Source	No. and % of House-holds	Source	No. and % of House-holds	Source	No. and % of House-holds
30	Piped water supply	58/77	Individual well	15/20	Deep tube well	2/3
42	Piped water supply	58/40	Individual well	29/20	Deep tube well	5/3
42	Agency	2/1	Both Piped and well	47/33	Piped and deep tube well	3/2
50	Piped water supply	42/39	Individual well	19/17	Deep tube well	1/1
50	Public well	32/29	Both piped and well	14/13	-	-

Source: Field survey, 2012

### Daily Water Use

The study reveals that the average water consumption rate per day/per household is found to be 444.6 litres while the average water consumption per head is found to be 90.6 litres in Guwahati city. Thus, per capita water consumption is found to be less than Indian urban standard of 135 litres (Vishwanath, 2013).

### Role of Private Suppliers

Increasing gap between demand and supply and subsequent failure of any planned efforts of the government to meet the basic need of drinking water has added much to the woes of the people. Such situation has in turn led to many private entrepreneurs make business out of it. For the last few years, private mobile water tankers are a common sight in the study area operating mostly without any legal framework. However, the private agencies played a very important role when it comes to meeting the needs, especially in winter seasons, when the scarcity of water goes up. Altogether 164 households out of 324 studied households are dependent partly on the private agencies for their water need. Percentage of households dependent on the private agencies in each specified wards are 30 per cent in ward No. 30, 76 per cent in ward No. 42 and 29 per cent in ward No. 50. It has been observed that from the core wards to the peripheries, the irregularity in supply goes on increasing due to faulty and outdated pipelines and leaks in the distribution network. The study also reveals that the number of households buying water from private agencies turns out to be comparatively higher in ward no. 42 than the other two wards. Approximately 76 per cent depend on agencies in times of the need of water. This is because water scarcity is highest in this ward owing to the intermittent water supply and groundwater level reduction.

### Source: Field Survey, 2012

Dependence on more than one source of water can be attributed to the unreliability of the piped water supply and reduction of groundwater level in the dry season. Such

conditions have made the people to opt for the only alternative source of drinking water available, which are the private suppliers. Therefore, during dry seasons when water supply becomes intermittent, it affects about 65 per cent (147 out of 225) of the households and with no other options left, except for depending on the private water suppliers. In fact, the private suppliers support about 51 per cent of the total households in these wards. Households used to spend a good amount ranging from ₹180 to 250 to the agencies for a tanker with a capacity of 600 litres, if hired from vicinity.

### Situation of Groundwater

There has been a perceptible reduction in the ground water level during the last 10 to 12 years affecting 79 per cent of households. The problem is far more acute for those households, who have either dug well or deep tube well as the source of potable water (Table 8). In ward no. 30, the average depth of dug well is found to be 25 ft. whereas, the average depth of deep tube well is found to be 150 ft. In ward no. 42, the average depth of dug well is 35ft and of deep tube well is found to be 200 ft. In ward 50, the average depth of dug well and deep tube well is 20 ft. and 200ft. respectively.

From a comparative analysis of the three wards in relation to the ground water level conditions, it is found that the number of people affected by the problem of water level reduction is more in ward no. 42. This can be attributed to the over-exploitation of ground water through haphazard growth of apartments, alongside other associated vertical growth. These apartments fail to provide the required amount of uninterrupted running water to its customers. To overcome the scarcity, the owners of the apartments prefer to go for boring wells for the extraction of ground water. In most of the apartments, it has been observed that these deep tube wells are the only source of water. However, such over-extractions of ground water from a limited parcel of land have led to the reduction of ground water level of ring as well as tube wells around the neighbouring areas.

## Problems of Drinking Water

Attempt has also been made to identify the problems relating to potable water based on data collected from the field survey and personal observations. Water scarcity was found to be a major problem in all the three wards. As mentioned above, the problem is more severe in the dry season when water supply becomes irregular and water level of the wells goes down. Approximately, 51 per cent of the population remains heavily dependent on private suppliers due to the scarcity of water (Table 9). Highest scarcity of water was found in ward no. 42 where 76 per cent of the respondents perceived a water scarcity situation. Against this, ward no. 50 suffers from lesser water scarcity, which has been perceived by the respondents as 31 per cent. Again, here too the most common reasons for the water

**Table 8: Groundwater Condition as Perceived by the Users**

Ward No.	Level decreased	Level remained same	No comment
30	77%	22%	1%
42	99%	0%	1%
50	70%	19%	11%

Source: Field survey, 2012

**Table 9: Water Availability and Scarcity as Perceived by the Users**

Ward No.	Households Facing Scarcity	Households Facing No Scarcity
30	34%	66%
42	76%	24%
50	31%	69%
Total	52%	48%

Source: Field survey, 2012

related to the rapid and haphazard growth of the wards alongside unplanned urbanisation process. In the case of the municipality water, as stated above, there is inadequacy of water supply, more especially during the dry winter seasons. Moreover, the existing public water supply facilities are running well below their capacity and require urgent investments and expansion. The Panbazar water treatment plant has already been suffering in relation to its outdated design and is in a very poor state,

scarcity are found to be irregular water supply and water level reduction, especially during the winter season. Under such circumstances, reliance on ground water should be minimised by giving emphasis on the use of river Brahmaputra as the main source of water for the city. Rainwater harvesting may also be encouraged among city residents to face the challenge of water deficiency.

The area also faces several problems in respect to water supplied by the municipality and water shortage due to deteriorating groundwater conditions. Some of the problems related to the ground water are—water level reduction, waterlogging during monsoon period, pollution from sewerage, unplanned extraction of ground water, high iron (Fe) content, etc. All these problems, except the high iron content of groundwater, can be which requires immediate renovation and augmentation, at least until the time the on-going modern drinking water supply projects are completed.

The distribution of water is sufficient to some extent to meet the demand of the area. However, there is transmission loss at certain places caused by leakages in the pipelines, which are hardly replaced with the new ones. The problem becomes more acute during the summer season. Due to leakages in the pipelines, muddy and polluted water enter these leakages and the water that reaches the consumers are very poor in quality and unfit for use. The network of pipelines can be said to be sufficient to reach the destinations, except for ward no. 50, where the supply is very poor in comparison to the other two wards (ward no. 30 and 42). This is the result of the hilly topography of the ward no. 50. People living in lower elevation get adequate water, while flow of water is found to be almost nil at the higher elevation.

Thus, it can be said that the status of drinking water in the study area is below the average standards set for India urban environment, which requires immediate attention. Although the city is growing very rapidly in many aspects in the name of external face-lift and

modernisation of infrastructure, it can be said that in terms of the growth of necessities the picture remains gloomy. The very basic necessities of life of the city dwellers are deteriorating over the years in its both quality and quantum. People are made to compromise with the basic needs of their existence.

### Conclusion

Water plays a crucial role in the improvement of the socio-cultural and economic endowment of man. As such, access to clean and protected drinking water has been treated as a fundamental right for the people in India. Although, there was not any well-planned public supply systems in the cities like Guwahati in the past, prevalence of small water tanks and wells excavated by the Ahom rulers emphasised the public welfare measures taken. Besides these wells and tanks, the river Brahmaputra and Bharalu also served as important sources of water for the people of the city in the past as well as now. Scarcity of drinking water also existed in Guwahati even in the historic past. Poor water quality often leads to widespread of water-borne diseases among the residents like Cholera and Kala-Ajar. However, nature and magnitude of the problems relating to drinking water changed over time. After Independence, initiative for public water supply took a shape through the formation of Guwahati local board and subsequent development of Guwahati Municipality Corporation. At present, the major source of drinking water in the city is municipality water. Individual well, deep tube well and public wells are found to be the convenient sources of water for the city dwellers. However, for a certain section of people the only sources of their drinking water is the commercial water supplying agencies.

Municipality water supply scheme covers 69 per cent of the households of the city. Supply is found to be more or less regular, except in dry season, when water supply becomes intermittent. The condition seems to be worse in the peripheral areas of the city where households receive water supply only once or twice in a month despite having municipal

water connections. Insufficiency of public water supply affects about 65 per cent users of the area that left with no option other than depending on the private water suppliers. Private water suppliers support around half of the households in the area. However, in the core area of city supply of water is found to be regular because it lies adjacent to water supply plants. The study shows that on an average 52 per cent of households face scarcity of water and highest scarcity is reported by 76 per cent households located at the peripheries. Briefly, it can be said that the status of drinking water availability in the Guwahati city is below the average Indian urban situation. Per capita water consumption is found to be 90.6 litres against Indian urban standard of 135 litres. The city is growing very rapidly in many aspects in the name of external face-lift and modernisation of infrastructure, but it can be said that in terms of the growth of basic necessities the picture remains abysmal and needs immediate attention. However, amidst the prevalence of the dreadful water supply facilities, with the on-going construction of the new water supply system, the Guwahatians continue to anticipate that 24x7 affordable, clean and reliable water supply service with adequate pressure would be achieved in near future, which would significantly improve their current standard of living.

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