

# Water Supply System in Kolkata City-A brief history on its chronological developments, strategic plans and future aims

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*Kolkata, erstwhile Calcutta, the former capital of British ruled India is one of the largest and populous metropolises of India. The city is basically divided into comparatively older northern & central parts and newly developed southern & eastern parts. The water supply of Kolkata Metropolitan Area (KMA) is primarily been serviced by two sources i.e. surface water from the perennial river of Hooghly and ground water sources.*

*Out of these two sources, the water from river Hooghly is being treated and supplied to a very limited portion of Kolkata Metropolitan Area (KMA) through the treatment plants except Kolkata, but majority of remaining KMA has to depend on the ground water source. In 1848, importance of pure and wholesome water supply to the city of Kolkata was given a top priority through proper legislation. In 1865, work of construction of 6 MGD water works started at Palta, situated 24 Km away from the northern side of Kolkata. Later, in 1905 supply was increased to 26.5 MGD by introducing pressure in gravity transmission pipe from Palta to Tallah. Since inception, the water supply system in Kolkata is continuously being strengthened, elaborated, modified, upgraded and augmented with modern technologies to supply safe and hygienic potable water to the doorsteps of the citizens. The overall system is characterized with water demand analysis vis-à-vis planning and implementation of resource development like addition of water treatment plants, reservoirs, pumping stations, primary, secondary and tertiary pipe network, efficient generation, transmission, distribution, water loss management, reservoir balancing, flow and pressure monitoring of water supply, leak detection and proper maintenance, timely restoration and management. With this effort, there is a gradual elimination of ground water extraction in time to come and augmentation of surface water throughout the city.*

**Keywords:** *Water supply, Kolkata city, chronological development.*

## 1. Introduction

Kolkata is the capital of the state of West Bengal, located on the eastern shore of India. It was the capital of British ruled India till 1912 prior to shift it to New Delhi. Kolkata metropolitan area is the third-most populous metropolitan area in India, with a population of around 14.72 million (As per 2011 Census) and a density of 7480

persons/Km<sup>2</sup>. The historic city of Kolkata is situated in the banks of River Hooghly having perennial source of surface water. It is the main port and has a vast hinterland covering the entire North Eastern region of India, and spreads westwards through Bihar, Orissa, parts of Uttar Pradesh and Madhya Pradesh. The city is called cultural capital of India and popularly known as City of Joy.

## 2. Kolkata Metropolitan Area: An Overview

Kolkata (88°30' eastern longitudes and 22°33' northern latitude) is situated 120 km away from Bay of Bengal at the eastern bank of river Hooghly. The Kolkata metropolitan area is spread over a huge area and comprises 3 municipal corporations (including Kolkata Municipal Corporation). Suburban areas in the Kolkata metropolitan area incorporate parts of the following districts: North 24 Parganas, South 24 Parganas, Howrah, Hooghly and Nadia.

Kolkata city, which is under the jurisdiction of the Kolkata Municipal Corporation (KMC) has now an area of 206.08 sq. km.



The east-west dimension of the city is comparatively narrow, stretching from the Hooghly River in the west to roughly the Eastern Metropolitan Bypass in the east—a span of 9–10 km (5.6–6.2 mi). The north–south distance is greater, and its axis is used to section the city into North, Central, and South Kolkata.

East Kolkata is also a section. The city is surrounded by river Hooghly to its west, Bidhannagar Municipal Corporation and EKW area to its east, RajpurSonarpur Municipality area in the south and Baranagar and South Dum Dum in the North.



### North Kolkata

North Kolkata is the oldest part of the city. It is characterized by 19th-century architecture, dilapidated buildings, overpopulated slums, crowded bazaars, and narrow alleyways, it includes areas such as Shyambazar, Hatibagan, Maniktala, Kankurgachi, Rajabazar, Shobhabazar, Shyampukur, Sonagachi, Kumortuli, Bagbazar, Jorasanko, Chitpur, Pathuriaghata, Cossipore, Kestopur, Sinthee, Belgachia, Jorabagan. The northern suburban areas like Baranagar, Durganagar, Noapara, Dunlop, Dakshineswar, Nagerbazar, Dum Dum, Belghoria, Agarpara, Sodepur, Madhyamgram, Hridaypur, Barasat, Birati, Khardah, Titagarh and Barrackpur are also within the city.





### **Central Kolkata**

Central Kolkata hosts the central business district. It contains B. B. D. Bagh, formerly known as Dalhousie Square, and the Esplanade on its east; Strand Road is on its west. The West Bengal Secretariat, General Post Office, Reserve Bank of India, High Court, Lalbazar Police Headquarters, and several other government and private offices are located there. Another business hub is the area south of Park Street, which comprises thoroughfares such as Chowringhee, Camac Street, Wood Street, Loudon Street, Shakespeare Sarani, and A. J. C. Bose Road. The Maidan is a large open field in the heart of the city that has been called the "lungs of Kolkata" and accommodates sporting events and public meetings. The Victoria Memorial and Kolkata Race Course are located at the southern end of the Maidan. Other important areas of Central Kolkata are Park Circus, Burrabazar, College Street, Sealdah, Taltala, Janbazar, Bowbazar, Entally, Chandni Chowk, Lalbazar, Chowringhee, Dharmatala, Tiretta Bazar, Bow Barracks, Mullick Bazar, Babughat etc. Among the other parks are Central Park in Bidhannagar and Millennium Park on Strand Road, along the Hooghly River.



### **South Kolkata**

South Kolkata developed later which includes upscale neighbourhoods such as Ballygunge, Alipore, New Alipore, Lansdowne, Bhowanipore, Kalighat, Ajoy Nagar, Dhakuria, Gariahat, Charu Market, Tollygunge, Chetla, Naktala, Jodhpur Park, Lake Gardens, Golf Green, Regent Park, Jadavpur, Garfa, Kalikapur, Haltu, Nandi Bagan, Santoshpur, Baghajatin, ChakGaria, New Garia, Garia, Ramgarh, Raipur, Kanungo Park, Ranikuthi, Bikramgarh, Bijoygarh, Bansdroni, Kudghat, Dhalai Bridge, Model Town, Netaji Nagar, Panchpota, Techno City, Tentulberia and Baishnabhata Patuli. Outlying areas of South Kolkata include Ekbalpur, Haridevpur, Hastings, Rajabagan,

Watgunge, Garden Reach, Khidirpur, Metiabruz, Taratala, Bartala, BNR Colony, Majerhat, Behala, Sarsuna, Joka, Barisha, Parnasree Pally, Thakurpukur, Maheshtala, Batanagar, Nungi, Budge Budge and Pujali. The southern suburban neighbourhoods like Mahamayatala, Pratapgarh, Kamalgazi, Narendrapur, RajpurSonarpur, Harinavi, Subhashgram, Mallikpur and Baruipur are also within the city of Kolkata (as metropolitan, urban agglomeration area).

### East Kolkata



East Kolkata is largely composed of newly developed areas and neighbourhoods of Saltlake, Rajarhat, Tangra, Topsia, Kasba, Anandapur, Mukundapur, Picnic Garden, Belegkata, Ultadanga, Phoolbagan, Kaikhali, Lake Town, etc. Two planned townships in the greater Kolkata region are Bidhannagar, also known as Salt Lake City and located north-east of the city; and Rajarhat, also called New Town and sited east of Bidhannagar. In the 2000s, Sector V in Bidhannagar developed into a business hub for information technology and telecommunication companies. Both Bidhannagar and New Town are situated outside the Kolkata Municipal Corporation limits, in their own municipalities.



### Economic Growth

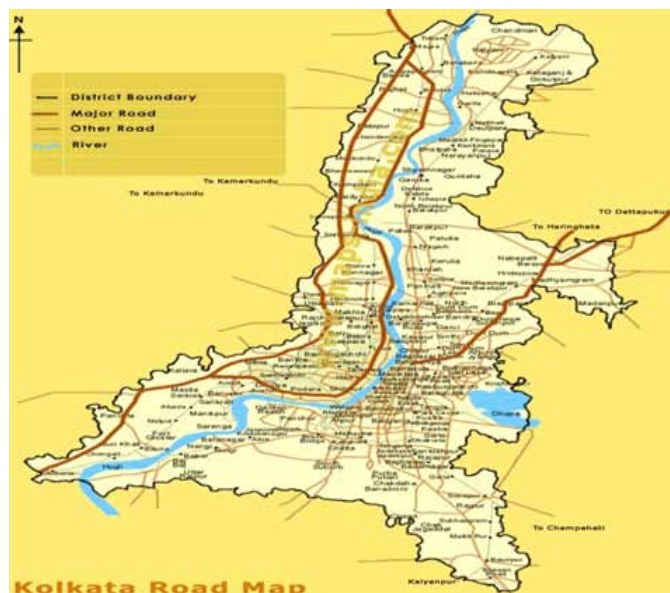
Kolkata is the commercial and financial hub of East and North-East India. The economic growth in the city has evolved with the time with more service sector growth and reducing primary and secondary sector inputs. Primary Sector which was contributing around 77% in 1985-86 has reduced to 56% in 2001-02 with tertiary sector (primarily IT, ITES and BPO industries) grown from 23% to 44% in the same period.

### Weather

Kolkata is subject to a tropical wet-and-dry climate. The annual mean temperature is 26.8°C (80.2°F); monthly mean temperatures are 19–30°C (66–86 °F). Summers (March–June) are hot and humid, with temperatures in the low 30 Celsius; during dry spells, maximum temperatures often exceed 40°C (104°F) in May and June. Winter lasts for roughly two-and-a-half months, with seasonal lows dipping to 9–11°C (48–52 °F) in December and January. May is the hottest month, with daily temperatures ranging from 27–37°C (81–99 °F); January, the coldest month, has temperatures varying from 12–23 °C (54–73 °F). The rainy season begins in the month of June and lasts up to October bringing in moderately severe rains with an average rainfall of 160.5 cm.



### Roadmap of Kolkata



### 3. Water scenario in Kolkata Metropolitan Area (KMA)

The Kolkata Metropolitan Area (KMA) is primarily been serviced by two sources i.e.

- (a) Surface water from the perennial river of Hooghly and
- (b) Ground water sources.

Out of these two sources, the water from river Hooghly is being treated and supplied to a very limited area of KMA through the treatment plants but majority of remaining KMA to depend on the Ground water source.

For the purpose of analysis, the population in KMA could be divided into two parts i.e. municipal areas and non-municipal areas.

The distribution of population and area in both these areas are described in table 1.1.

Table 1.1 Allocation of land and population in KMA		
Particulars	Total Area (Sq. Km.)	Population* (In Millions)
Non Municipal Areas	964.61	2.35
Municipal Areas		
- Kolkata Municipal Corporation	185.00	4.57
- Chandannagore Municipal Corporation	22.22	0.16
- Howrah Municipal Corporation	52.74	1.00
- Other Municipal Bodies	614.67	6.64
Total	1839.24	14.72

\*As per census 2011

#### 4. Water scenario in Kolkata Municipal Corporation (KMC) Area

In 1848, importance of pure and wholesome water supply to the City was given a top priority through proper legislation:

- ◆ In 1865, work of construction of 6 MGD water works at Palta situated 24 Kms. away from the northern side of Kolkata.
- ◆ Between 1888 to 1893 filtration capacity of Palta was increased from 6 MGD to 20.5 MGD.
- ◆ In 1905 supply was increased to 26.5 MGD by introducing pressure in 42" & 48" dia. C. I. gravity transmission pipe from Palta to Tallah.
- ◆ Between the year 1907 and 1911, capacity of the plant was increased from 26.5 MGD to 37.5 MGD with addition of 4 nos. primary settling tank and construction of few more slow sand filter bed.
- ◆ Between the year 1922 and 1936, generation capacity was increased gradually from 37.5 MGD to 100 MGD. But, in the 1961 it came down to 80 MGD.

◆ From 1870 to 1933, per capita supply increased gradually from 15 gallons to 64 gallons and this was again decreased to 31 gallons in 1951 and only 27 gallons in the year 1961. Again in 1962, expansion scheme of 60 MGD. Was taken up to increase the capacity to 160 MGD.

◆ Calcutta Metropolitan Water and Sanitation Authority (CMW & SA) presently known as KMW & SA was formed through enactment on 2.10.1966. It was created with the purpose of maintenance, development and regulation of water supply, sewerage and drainage services etc. for the CMA with a view to promotion of public health and for matters connected therewith. In the field of water supply, KMW&SA has constructed and was operating and maintaining 60 MGD (272 MLD) at Garden Reach Water Works situated at the southern side of Kolkata from where KMC was getting water of 40 MGD.

◆ Kolkata Municipal Corporation further taken augmentation of 100 MGD at Palta Water Works in three phases. First phase was commissioned in the year 1997 with 20 MGD capacity and total capacity had gone up to 180 MGD.

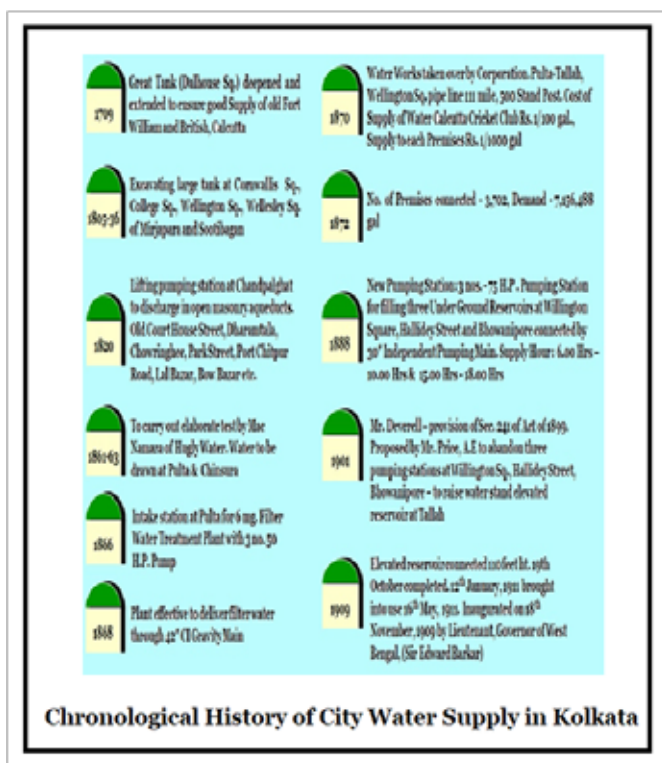
◆ KMW&SA has further augmented their production capacity at Garden Reach Water Works of 60 MGD in May 2001. KMC has started receiving 82 MGD of water from Garden Reach Water Works.

◆ In 2nd phase 40 MGD was commissioned in the year 2004 and total capacity gone to 220 MGD.

◆ Construction of 40 MGD Plant was completed in the year 2006 and the plant capacity of Palta was further augmented to 260 MGD.

◆ KMC has added two water treatment plants with pumping stations at Wattgunge Square having capacity 5 MGD and at Jorabagan Park having capacity 8 MGD respectively and these plants are in operation since Jan, 2006.

◆ KMC has taken over the Garden Reach Water Works from erstwhile Kolkata Metropolitan Water Supply and Sanitation Authority (KMWS&SA) w.e.f.



July, 2011 and presently its operation and maintenance is being carried by KMC.

- ◆ KMC has further strengthen its transmission capacity for carrying treated surface water from Palta to Tallah Reservoir through a project under JnNURM intervention by laying a Dedicated Transmission Main having 64" diameter from Palta to Tallah and the same was commissioned on September, 2012. The main is now effective transmitting treated surface water from the Treatment Plant at Palta.
- ◆ KMC has completed construction of Dhapa WTP and its related distribution system and people residing at the eastern fringe of the city are getting benefit out of it. This system is under operation since December, 2014.
- ◆ KMC has completed and recently commissioned another mega project for augmentation of Treatment facility at its Garden Reach Water Works having 110 MGD Raw Water Jetty, Pumping Station and 50 MGD WTP. Now, the plant capacity raises upto 185 MGD.
- ◆ KMC has completed and recently commissioned one 20 MGD WTP by refurbishing its old 18 MGD Rapid Gravity Filtration Plant, which was lying at dilapidated; in phased manner through ADB financing. This WTP was constructed by utilizing the space of old Rapid Gravity Filter Plant.
- ◆ KMC has already taken up another 25 MGD WTP adjacent to its Garden Reach WTP and work is in progress.
- ◆ KMC has further taken up refurbishment of Century Old Tallah Tank to enhance its service life to another 50 years and it is in progress.
- ◆ As a part of switching over modern Water Supply distribution management process, KMC has taken up a prior project of water loss management at Ward no. 1 to 6, Cossipore service district and it is in progress.
- ◆ KMC has also taken up one expeditious and challenging project for rejuvenating its oldest WTP at Palta through shore protection of its river bank to safe

guard its raw water intake facility as well as plant itself against soil erosion and it is in progress.

- ◆ This initiative has also planned to be extended for Dhapa Distribution command zone initially and will be further extended to remaining part of the city in due course under ADB financing.
- ◆ Further planning for augmentation of Dhapa WTP capacity to another 20 MGD has been conceived in addition to integrated transmission and distribution system for this command area to cope up with the rising demand of population.
- ◆ Small UGR, Headworks and Booster Pumping Stations are also considered in the master planning of Water Supply Department for the city for effective distribution of water supply.

Due to age-old system of water treatment plant, we are not able to achieve 100% efficiency of plant capacity. At present we are getting water at 80% efficiency. There is also problem in age old transmission mains, which are not capable of carrying required quantity of water, require thorough refurbishment. As water is coming from treatment plant to storage reservoir continuously (24 hours a day), there is no scope to close down the transmission main for refurbishment. K.M.C. is thinking an alternative route for laying a transmission main so that refurbishment can be done by closing the existing transmission mains one by one. After this refurbishment, K.M.C. will develop the water treatment plant for carrying more water in future.

### **5. Need for Development of surface water source**

Kolkata City is North-South bound. Its water supply arrangement has been provided, by this time, from two sources – one at Palta (within Barrackpur district), supplying water to KMC storage station at Tallah which is at the extreme North of Kolkata City. The other filter water supply source was maintained and operated earlier by KMW&SA, a sister organization of KMDA and the same was taken over by KMC since July, 2011, which is at the extreme South end of Kolkata City. North-South City area has already

been developed and growth is being observed at the eastern part of Kolkata along E.M. Bye-pass. The eastern portion of Kolkata City is first developing and huge multi-storied buildings are coming up as the prospective growth set back. This area is naturally supplied with individual ground water sources and in a small way by KMC also through deep tubewell.

Ground water contents high dissolved solids and salinity. There has some threatening of arsenic contamination in ground water, which is now within desirable limit in the city as per *Central Public Health and Environmental Engineering Organisation* (CPHEEO) manual. Some tubewells have already been closed in which arsenic content is beyond desirable limit. It was reported that eastern zone of Kolkata city is adjacent to arsenic threatened area like Sonarpur, Baruipur etc. Development of surface water source is urgently required now and need of the hour, particularly at eastern zone of Kolkata City. It will help KMC to avoid extraction of ground water for facilitating the potable water supply in some parts of the city and also to achieve the objective of sustainable development of quality of life (QOL). The approach should be comprehensive one and development action should be incremental over space and time with a scope of producing proportionate benefits. Therefore, the objective is to provide safe water and adequate sanitation services to specific target population within a specified time frame. With this objective, KMC has commissioned Raw Water Intake Jetty with pumping station at Ma-er Ghat (Bagbazar), Raw Water pipeline and 30 MGD Water Treatment Plant at Dhapa alongwith its distribution system to cater the need of Flittered Water demand of the Eastern fringe of the city in recent past.

KMC has completed and commissioned another project for construction of 110 MGD Raw water intake Jetty, Pumping Station and 50 MGD Water Treatment Plant at Garden Reach to augment treated surface water supply at southern part of the city, Joka and its suburbs.

Further KMC has taken up another WTP having

capacity 25 MGD adjacent to Garden Reach Water Works considering provision of extending filtered water supply at Southern Kolkata, Behala, Garden Reach and adjacent area. This project is nearly on completion stage.

## **6. Strategic Future Plan for Water Supply**

The objective of development in the sector of water supply is to ensure availability of safe potable water to all. To achieve this basic objective, norms & standard for water supply has been marginally adjusted to utilize the existing facilities to the maximum extent. As a part of this effort KMC is now planned to strengthen its existing installation as well.

Notwithstanding to speak that transmission and distribution of safe portable water to the doorstep of the citizen is a basic objective of KMC with a focus to supply the same with hygienically and best of its quality at par with the national standards. Retrofitting programme of Century old Tallah Elevated Steel Reservoir will enrich KMC to serve the Citizen in a better way. Water Loss Management Project at Cossipore area will help KMC to generate awareness to the people of this segment as well as to extend filter water duration to 24X7 as against 18 hours a day at present. KMC also plan to extend supply duration in the other part of the city by envisaging similar type water loss management programme there. As a part of strengthening existing infrastructure KMC has undertaken shore protection work to safeguard its biggest WTP at Palta. Efforts are to be made to reduce wastage. Special attention needs to pay to ensure that quality of water remains within stipulated standards. Due considerations have been given for the economically weaker section and their social habits. Initiatives have also been taken to extend treated surface water supply to the doorsteps of the residents of the city and as a part of this, KMC has now planned to augment its storage capacity alongwith treatment facilities, so that safe drinking water can be provided to the citizen. KMC has also planned to closed down its ground water source and replace it by treated surface water. It is also needless to mention that KMC



has pioneer in the sector of modern computer-based management in the water supply sector in this country. It has started the initiative of water loss management, reservoir balancing, flow and pressure monitoring of water supply system to check its health continuously and instantaneously since 1997 with the help of Indo-French Protocol. The system has been modified and upgraded on and after 2013 with the help of ADB financed project. This system gives us alarm on its flow, pressure and health of the system on regular basis and help KMC for rendering better civic service as far as water sector is concerned. Further, 3rd Phase of upgradation of this system is under progress, ward no. 1 to 6 have been selected as pilot zone for water loss management study, reservoir balancing, flow and pressure monitoring, leak detection and restoration, domestic consumption study and its characteristic analysis etc. The same study has also been extended to few wards of Jadavpur area.

## **7. Conclusion**

With these efforts, KMC aims to eliminate ground water extraction gradually and proceeds to provide

treated surface water throughout the city in near future.

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