CHAPTER - IV
DRAINAGE STATUS
A detailed account of artificial and natural surface drainage system is presented in the present chapter.

DRAINAGE SYSTEM

Far back, in 1803, Lord Wellesley was struck by the drainage conditions prevailing in Calcutta. Therefore, the drainage problem which is so acutely felt by Calcuttans today is not recent in its origin. Almost two centuries back Wellesley observed that the construction of the public drains and water courses of the town was extremely defective. These neither catered the purposes of cleansing the town nor of discharging the annual inundations occasioned by the rise of Hooghly river or excessive monsoon downpour. Therefore, a committee was appointed having regard to the enormous mass of evidence before them about abominable condition of the drains and ditches. The committee came unhesitatingly to the decision that the only satisfactory remedy to the waterlogging problem was the construction of underground drainage system.

Mr. Clark, an eminent and experienced sanitary engineer was to prepare drainage scheme. After a revision and modification of Clark's Scheme in 1857, which made salt water lakes, the receiver of drainage of the town, was opposed by Messrs. Randel. They found the project costly and recommended the Hooghly river as an outfall channel.

The Municipal Commissioners, after a due consideration, strongly opposed Messers. Randel's Scheme as a proposition perfectly impractical. It was not only uneconomical but
improper also to disgorge the whole sewage of the town into the river. It not only would cause a menace to the sanitation, also would prove to be detrimental to the Calcutta Port. Therefore, Clark's Scheme was modified and adopted by the Drainage Committee.

The sanction of Government to Clark's scheme was received early in 1859 and work started immediately:

The objectives were:

1. Remove subsoil water;
2. Remove the drainage of the houses;
3. Remove rainwater.

Mr. Clark's system was a combined system. The sewage was to be pumped at the outfall, and bulk of rainwater was to be discharged into the circular canal. The sewers were practically completed in 1875. The efficiency of all drainage system being dependent on a sufficient water supply, which was then 8 million gallons, receiving their considerations, as also a substantial increase in the unfiltered water supply by the establishment of a new pumping station at Mullick Ghat.

Clark's Scheme stood the test of time. The only modification appeared necessary during the investigations in the nineties
DRAINAGE OUTFALL SYSTEM
CALCUTTA

River
Ganga

TOLLYS NULLA

BALLYGANJ
D.P.S.

PALMER BRIDGE
D.P.S.

TAPSIA
POINT

DHAPA
LOCK D.P.S.

KRISHNAPUR Canal

BANTAL PIP

Panchannagram
Canal

CHOBAGHA
D.P.S.

Fig. 4-0

Source: NATH et al., 1990.
of the last century, was regarding the outfall arrangements. A storm water connector was built from the circular canal in 1883 due to the growing quantity of sewage and storm water. (fig.4.0)

A headcut and storm water reservoir were executed between Palmer's Bridge and Bidhyadhari river at Bantala. These were brought to use in 1906.

There are about 40 miles of brick sewers in the town area and 26 miles in Suburban area. Length of the pipe sewers is 136 miles in the town area and 56 miles in suburban area. Altogether there are about 258 miles of sewers. (fig.4.1)

The history of Calcutta sewerage can be divided into four phases:

1. Initial Stage (1859-75) Clark;
2. (1875-89) Mr. Kimber, Chief Engineer; completed sewerage work.
3. (1891-1902) - Various projects of drainage work concerning the suburban area were completed by Mr. Kimber and Mr. Hughes respectively;
4. The final period when Mr. Ball Hill carried out to completion of whole scheme of the drainage of the added area.

In May, 1903 serious deterioration of the river Bidhyadhari was noticed. Adam William's report showed
that in the last 9 years the river bed silted up 24.7'
or at the rate of 2.75' per year. Rate of silting doubled
since 1904. Thus decay of Bidhyadhari was cause of death
of Peali and upper reaches of Matla.

REASONS OF DECAY

1. Change of method of fish culture in the salt lakes;
2. Most of spill channels were kept closed with cross
dams resulting in deposition of silt carried up by the tide.
3. Reclamation of salt lakes for paddy cultivation
decreasing the area of the spill.

CAUSES GIVEN BY MR. LEES (COMMITTEE MEMBER)

1. The construction of Dhapa Lock;
2. The closing of many tributaries of Bidhyadhari to
the parent stream into each of which the tide used
formerly to flow and ebb freely;
3. The reclamation of Bhangar Khal;
4. The reclamation of salt lakes for paddy cultivation.

As a result in 1935 proposals for shifting the outfall
channel to Kulti river was accepted and executed.
CALCUTTA COMBINED SYSTEM ZONE
PROPOSED FACILITIES AND
PROPOSED MODIFICATIONS TO
EXISTING FACILITIES

BRIEF LAYOUT OF THE EXISTING UNDERGROUND DRAINAGE SYSTEM

The Calcutta system is the only combined system within the CMD. The Calcutta combined system is located within the Corporation boundary. The circular canal forms the north and north-east boundary; tracks of the Eastern Railway form a common south-east and southerly boundary with Tollygunge and the Panchannagram; The south-westerly boundary is approximately along the line of the Chetla Boat Canal. The Hooghly river forms the westerly limits. (fig.4.2)

THE SUBURBAN SYSTEM

The suburban systems area is intensively developed. Kidderpore, Watgunge and Mominpur are congested residential and commercial areas. Alipore, New Alipore, Bhowanipore, Kalighat, Ballygunge, Entally are all congested areas. At the extreme westerly limits of Tollygunge, there is a small sewered area forming part of the suburban system.

The general arrangement of the suburban system consists of combined trunk sewers discharging in an easterly or South easterly direction to a major pumping station at Ballygunge. From here sewage is lifted to two high level gravity sewers leading to Topsia Point A and thence to the kulti river. Storm water is pumped at this station to the Calcutta Corporation Storm water channel which connects with other such channels, leading to the kulti river. (fig.4.3)
THE TOWN SYSTEM

The area served by the Town system includes the oldest part of the city in vicinity of Dalhousie Square. The northern and easterly high density residential cum commercial areas. Southeasterly areas contain high-value residential property. The southwest consists of Maidan and Fort William.

This combined drainage and sewerage system consists of trunk sewers discharging by gravity in an easterly direction from relatively high ground in the immediate vicinity of the Hooghly river to a system of intercepting trunk sewers located in and east of upper and Lower Circular Road. These intercepting sewers discharge to Palmersbridge pumping station, whence sewage is pumped to two high-level sewers discharging at Topsia Point A. Storm water is lifted at Palmersbridge pumping station to the Calcutta Corporation storm water channel. (fig.4.4).

Tollygunge, Maniktala and part of Panchannagram, covering some 15 Sq.ml. are sewered by the existing combined system. This system is divided into two roughly equal areas with the northern part served by the town system and southern half by the Suburban system.
Population projections for the existing and proposed area of sewerage service are listed below:

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961</td>
<td>2,070,000</td>
</tr>
<tr>
<td>1971</td>
<td>2,127,000</td>
</tr>
<tr>
<td>1981</td>
<td>2,185,000</td>
</tr>
<tr>
<td>1991</td>
<td>2,202,000</td>
</tr>
<tr>
<td>2001</td>
<td>2,219,000</td>
</tr>
</tbody>
</table>


Table - 4.2

Estimated Total run-off - Calcutta Quantity pumped out

<table>
<thead>
<tr>
<th>Area</th>
<th>Total Run-off</th>
<th>Quantity Pumped Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Maniktola</td>
<td>1.325 Cft.</td>
<td>300 Cft.</td>
</tr>
<tr>
<td>B. Calcutta</td>
<td>5912 Cft.</td>
<td>2360 Cft.</td>
</tr>
<tr>
<td>C. Cossipore</td>
<td>246 Cft.</td>
<td>96 Cft.</td>
</tr>
<tr>
<td>D. Tollygunge</td>
<td>3186 Cft.</td>
<td>450 Cft.</td>
</tr>
<tr>
<td></td>
<td>10,670 Cft.</td>
<td>3206 Cft.</td>
</tr>
</tbody>
</table>


THE PRESENT SURFACE DRAINAGE AND CANAL SYSTEM OF CALCUTTA:

The Hooghly

The channel cross-section is usually asymmetric and the deep part moves from the right to the left from one bend to the other. Below Howrah Bridge the deep part of the channel runs along the Calcutta side. The constancy of the Hooghly channel depends more or less on the harmonious interplay of the ebb and flood currents as modified by the curvature of the banks and width of the river bed.
The upland flow dominates during August to September. The tidal flow dominates during January to April while they are balanced during May to June. The Hooghly caused floods overtopping its bank in 1660, 1684 and 1823.

**BIDHYADHARI AND KULTI RIVER SYSTEM:**

During the later part of the last century the once active Bidhydhari river on the eastern fringe of Calcutta and other distributaries of the Hooghly were silting up. When the river was active, it was under the tidal influence of the Bay of Bengal, which resulted in flooding of the area. Gradually, the tidal influence stopped due to silting and the spill area of the river become an agglomerate of stagnant pools of water—both brackish and rain water. During 1930's this spill area was gradually converted into sewage fed fisheries and Calcutta's sewage became main source of water (non-brackish) supply in these low-lying areas.

The Bidhydhari river had a cross-sectional area of barely 173 Sq.mtrs. in 1830 at Bamanghata. It rapidly increased to 1230 Sq.Mtrs. in the same area in 1883. The whole region was the spill area for the river Bidhydhari. But after construction of a series of artificial cuts that joined the Bidhydhari to the Kulti Gong, more spill channels were thrown into the basin of the river Kulti—the only outfall receptacle for Calcutta sewage. (fig.4.5)
Moreover, free spill into the Salt Lake area were curtailed both naturally and artificially. The Bidhydhari dwindled her sections from 1230 Sq.Mtrs. in 1883 to 425 Sq.Mtrs. in 1904. By 1928, reduced its section to barely 200 Sq.Mtrs. after which the river was officially declared useless by Bengal Government either for drainage or for navigation purpose.

Adi Ganga

Adi Ganga helps in cleansing the western section of the city mainly Alipore, Kalighat, Chetla, Tollygunge, Bansdroni etc. The river is in a very aggraded condition and only works partially in moonsoons. (Plate 4.1)

Profile of Canal System

The present canal system mainly comprises of Bagjola canal in the northern most fringe, the circular canal in the central area with two branches and the Tolly's nullah in extreme south. The original purpose of these canals was to have a direct and natural flush out of system in link with the Hooghly river. The canals served other purposes too like navigation for agricultural products, irrigation and supply of vital nutrients to the fishery ponds. (fig.4.6).

Bagjola Canal

The Bagjola canal after originating in the swamps near Ariadaha now continues as a narrow ditch till it reaches
4.1 Adi Ganga at the point of origin near Kidderpore. Condition of the channel is notably good with easy flow of water and greeneries on both sides.

4.2 Bagjola Canal which is more or less in a better condition than the other canals.
south Dum Dum. A number of outfalls contributed towards its later inflation, flowing through recently cemented bed, finally coming out on VIP Road near Krishnapur. Of all the canals surveyed, Bagjola canal seems to have least impact of unplanned human settlements on its bank. The untreated sewage and carcasses appear to have direct effect on growth of water hyacinth in parts of the canal. Beyond VIP Road, the canal continues through Rajarhat area outside the urban limit before meeting the estuarine area of Kulti-Bidhydhari System. (Plate 4.2)

Circular Canal

The circular canal originates from Hooghly in Bagbazar and was known as Maratha ditch in the past. The canal from the point of its origin present a picture of highest population density (25 huts in 100' in linear axis) along its now silted bank. The settlers use the canal as direct point of defecation and dumping of solid waste, untreated effluent from underground drainage outfalls contribute to the high level of organic matter. The population on both sides comprises of landless or marginal farmers from south 24 Parganas in a stretch of 2-3 km. from Bagbazar to Ultadanga. Area is widely used as warehouses for agricultural products. (Plate 4.3)
4.3 The Bagbazar Canal has a reasonably good flow as it moves eastwards but human interference affects its flow.

4.4 The Krishnapur Canal as it approaches salt lake city flows in a wide channel.
4.5 The well maintained Krishmapur canal beside Salt Lake city.

4.6 Circular Canal shows signs of human encroachment near Manicktala, but still, the canal flow is satisfactory.
4.7 Circular Canal approaching Rajabazar gets suddenly narrower and strewn with solid wastes.

4.8 Circular Canal between Rajabazar and Beliaghata is most adversely affected. The channel bed is clogged with solid waste dumped from the bustees on either side.
The circular canal becomes bifurcated near Ultadanga Road bridge and one branch, Krishnapur canal proceeds north-east, crosses VIP Road and runs parallel to Salt Lake and then encircles Salt Lake City to finally join Kulti river near Ghughata. The stretch parallel to Salt Lake City presents a view of wide water ways lined with planted greenery but often clogged with water hyacinth. The Krishnapur canal still plays an important role in irrigating small lands and get used as water way. (Plate 4.4, 4.5)

The other branch of circular canal continues as Beliaghata canal, along the canal East and canal West Road and traverses Manicktala, Rajabazar, Beliaghata area before reaching Dhapa-Lock Gate. A link has been established between Krishnapur canal in further north-east and Beliaghata canal and then rest of outflow being pumped out to the outfall channels through an underground duct. (Plate 4.6)

The stretch of Beliaghata canal from Ultadanga road Bridge to Dhapa Lock P.S., on Eastern Metropolitan Bypass exemplify the effect of human interference. The water appears black, grey and bubbles with noxious gases as untreated effluents from industries, biological pollutants from settlers and carcasses of animal are dumped into it. (Plate 4.7, Plate 4.8).
4.9 The Tolly’s Nullah near Keoratala Ghat shows signs of sedimentation and deterioration.

4.10 The Tolly’s Nullah near Bansdroni is filled up with water hyacinth and vegetation growth.
4.11 The Dry Weather Flowchannel leaves Topsia and approaches Eastern Metropolitan Bypass.

4.12 Small planks of industrial sector pollute city environment beside Dry Weather Flow channel at Dhapa.
Tolly's Nullah

The Tolly's nullah was re-excavated by Major Tolly during 1770-1775 on the Adi Ganga for the benefit of Pilgrims to Kalighat. The canal passes through Kidderpore area and gets bifurcated near Kudghat. From here one branch takes the course along Netaji Subhas Chandra Bose Road in Tollygunge and reaches Garia. This stretch is now in a highly polluted condition. Beyond Garia it flows eastward and remain severly restricted due to human encroachment and trickles all the way to meet Bidhyadhari in the east. (Plate 4.9)

The other part of the canal flows through Kudghat, Sonarpur and ultimately reaches Sundarbans via Canning and Matla river. (Plate 4.10)

Dry Weather Flow Channel (DWF)

It originates at Topsia D.P.S. for disposal of sewage effluent to Kulti river. On their way, DWF channel deposits the silt into the world's largest sedimentation tank (measuring 84m with an average depth of 4.1 m and carrying capacity of 3.75 million gallons) at Bantala, 6 km. from Topsia. The DWF channel is supposed to carry silt free water to Kulti river and the silt was meant to be utilised through 7 lagoons for use as fertilizer. The DWF channel is designed to carry full load discharge of 670 cft. per second. Its width varies between 6-10m and depth 2m. (Plate 4.11, 4.12) (4.14, 4.15, 4.16).
4.13 The Storm Weather Flow Channel has a wide channel clogged with hyacinth at various places.

4.14 The Bantala sedimentation tank, the world's largest
The Storm Water Channel (SWF)

It originates at Ballygunge pumping station also passes through the Bantala area but has a much higher carrying capacity of 2270 cusecs, with a breadth of 50 m and depth of 4-6 m. It runs parallel to the DWF channel on Dr.B.N.Dey Road for a distance of 50 km. Water of both these corporation channels are extensively used for irrigation and pisciculture. (Plate 4.13)

It is interesting to note that a Samudragiri Khal was excavated earlier to connect Tolly's Nullah and SWF Channel near Samukhpota to boost the water supply for irrigation and pisciculture. But lack of funds hampered excavation work and the desired results were not obtained.

Parallel to the DWF Channel runs another channel called "Fishery - Feeding channel" from Topsia area for the specific purpose of supply of nutrient-laden water to "BHERIS" in the lagoon.

Only about 150 mtrs. north of the point where DWF and SWF terminate at Kulti - Bidhyadhari river system through a lock gate at Ghusighata, joins the Krishnapur canal. The net discharge at terminal points of these channels is estimated to be 4000 cusecs.
4.15 Huge investments were made at the Bantala Project.

4.16 The sedimentation tank, at Bantala is now closed.
Kulti River

The Calcutta Corporation's outfall works for carrying the untreated wastes of that city for final disposal in the Kulti River were completed in 1930s. Since that time the river has served as the receiving water for purposes of untreated waste disposal for the Corporation area. Presently, the river disposes of the wastes of a population of above 2.9 million.

The Kulti river outfall channel was built with the expressed objective of protecting the waters of the Hooghly river from contamination. The Kulti river has already proven its value as a wasted outfall channel.

It appears that the present arrangements for disposal of untreated wastes in the kulti river are satisfactory and should be continued. In as much as this kulti river outfall system flows through relatively undeveloped rural area there is little probability that in foreseeable future, significant health hazards or nuisance conditions will develop.

The combined artificial drainage system is not adequate for the present load of drainage water. Water logging results from the failure of the storm water channel specially when concentrated heavy monsoon downpour occurs.
The surface canal system is not maintained at the desired level thus often failing to drain the surface drainage load.

Reference:


