ABSTRACT
Sustainable and innovative infrastructure planning is the need of the hour. The plan to meet the water supply requirement for the upcoming new town at Rajarhat located in the eastern fringes of Kolkata is one example of innovative sustainable and economical urban planning. The transfer of water, in right quantity and quality from the river Hooghly to the new town treatment plant through the existing Kestopur Canal has been preferred to transfer through pipeline. The economic and environmental implications of this preferred mode to transport water have been discussed in this paper.

1. INTRODUCTION
Presently, for India’s real prosperity and growth we require innovative planning and management, which is sustainable and economic as well. India has to have a goal that every Indian should enjoy equal opportunities and get a chance to live a minimum quality of life and contribute to the society. Unfortunately, today India is getting divided into the rich and the poor, where the rich enjoy all the capital intensive infrastructure facilities, whereas the poor are deprived of the same. This cannot continue and a balance has to be reached where there is a more equitable distribution. For the growth of India in all respects, the country cannot be divided into the haves and have-nots. In this article, an attempt has been made to cite some solutions on the above lines that have already been planned and are being implemented. One such example is the water supply system in new town, Rajarhat. Along with it we have also added our thoughts on the issue of sustainable planning and management and how to make it more workable.

2. MAJOR IMPEDIMENTS
Along with the population influx in India severe inadequacy and non-availability of good quality social infrastructure (education, health, sports, etc;) and physical infrastructure (roads, water supply, sewerage and drainage) are being felt. The severe lack of infrastructural facilities is causing serious impediments to India’s development. They are causing several kinds of problems both in cities and towns as stated below:

- Poor literacy rate leading to poor human resource development, resulting in poor quality of life,
- Poor health, lower life expectancy and malnutrition,
- Physical and mental illness,
- Poor marketing of agricultural products causing higher food prices due to lack of proper roads,
- Poor land use zoning regulation and its implementation causing water logging in cities causing loss of wealth, as well as air, water and noise pollution,
- Large scale unemployment amongst the semi skilled and unskilled. Unfortunately education does not reach the poorest of the poor,
- Low per capita national income and GDP,
- Increasing crime rate due to poverty and unemployment,
- Absence of adequate urban planning is resulting in deteriorating urban environment and increasing number of slums,
- Presently one third of India’s urban population lives in slums.

As per census of 2001 India’s total population was 1,027 million and total land area is 3.28 million sq km leading to a land man ratio of 0.00319, which is one of the lowest in the world. This has led to a huge gap with the provision of infrastructure and its supply.
The Problem associated with the provision of infrastructure is primarily caused due to lack of responsiveness of the mass that are mostly uneducated and can not place their demand systematically. Other factors include bad maintenance of roads, wastage due to leakages in water pipelines, operational deficiencies, and inefficient maintenance of work handled by unskilled person, organizational multiplicities and many other issues which are not being discussed. However, operational management is not the focus of this paper.

Provision of infrastructure is mainly guided by political decisions which are cost intensive and often not well planned. Excessive presence of profit motivated promoters, often not adequately qualified, are entrusted to deliver infrastructure facilities, whereas the role of engineers, urban planners and policy makers are being ignored. However, they are the people who can do cost efficient, innovative, sustainable design and planning. However, to the uneducated mass a picture is being given that ‘scarcity of resource is the main cause.’ Scarcity of resources is one of the causes, not the main cause. Further, there are many ways to raise resources and mobilize human resources for the country’s development and infrastructure building.

An in-depth understanding of the above situation reflects that by considering the suggestions given below the supply of infrastructure facilities in India can become much more cost efficient and sustainable. Upgrading of comprehensive and holistic urban planning process with the help of public health engineers, urban planners, economists, environmentalists, geologists’ policy makers and other necessary experts as this in turn will save lots of resources. Preparation of Comprehensive Plan should be made team work where an urban planner should coordinate the work. However, it is necessary to understand comprehensive urban planning.

Location of various urban land uses should be done in a compatible way as well as to maximize benefits and maximize public welfare. The available resources such as canals, rivers, high yielding land, buildable land, undevelopable land, hillocks, forest land, non-fertile land, wetlands, land which will be required for construction of future, airports, sea ports, etc; should be given due weight while preparing the plan. For putting land under different land uses there should be categorization of land. Fertile lands, wetlands and other good quality land has to be put in one category and barren, unbuildable land has to be put in the other special category. These special categories of land should be put to use for development of industries instead of using high yielding fertile land. Canals, rivers and wetlands should be conserved for ecological reasons and can be used for navigation, drainage and irrigation purposes.

Planning should be such that it keeps environmental pollution to the minimum. Most importantly, the focus of comprehensive planning will be three Rs that is Recycle, Refurbish and Rejuvenate or Renew. This will automatically help in cost reduction and better quality of environment. With this background, the focus of the paper is on innovative, sustainable and cost effective ways of providing water supply system to Rajarhat new town.

3. INTRODUCING THE RAJARHAT TOWNSHIP

Rajarhat is a new township that is coming up north east of Kolkata at a distance of 10 Km from the existing CBD of Kolkata (Fig. 1). The new town is planned for a population of 7.50 lakhs and an additional floating population of 2.50 lakhs. Apart from residential development, other land uses would include a new business district and industrial areas, open spaces, recreational areas, institutional areas, landscaping. The new town has made an attempt to do its town planning in a sustainable, environment friendly and economic way. The location of the new town is adjacent to Salt Lake only separated by Kestopur canal on two sides which form the geographic boundary of the new town. Again, on the other side it is adjacent to Kolkata recycling region. The Waste Recycling Region (WRR) has been declared as a Ramsar Convention Site. It is interesting to note that attempts are being made to fully utilize Kestopur canal for bringing potable water to the township and WRR zone for recycling of sewage water solid waste for fresh production and agricultural
This paper concentrates on sustainable and economic provision of water supply for the new town.

There will be a comprehensive provision of water supply for Rajarhat new town to offer quality and convenient living for the residents. Surface water available from the river Hooghly will be supplied after treatment in the water treatment plant located in the new town, in line with the scale of development of the township. It is proposed to take up the water supply scheme in phases. Except treatment facility and pumping arrangements, all other components are designed in a sustainable way which will bring down the cost of water supply.

An assessment has been made about the future demand of the new town in its ultimate stage, considering a residential population of 7.5 lakhs and an additional day time population of another 2.5 lakhs. Assuming a standard consumption of 140 liter per capita daily (LPCD) for the residential population and 45 LPCD for the floating population (HIDCO, 2005).

4. SUSTAINABLE PLANNING AND MANAGEMENT OF WATER SUPPLY SYSTEM

Initially, two alternatives were considered by HIDCO (Housing and Infrastructure Development Corporation). First alternative was to bring water to the new town through pipelines and second alternative being to bring the water through the existing Kestopur canal which surrounds the new town to the water treatment plant located. Finally, the cost effective, sustainable and time saving alternative has been adopted and work in this regard has already begun (The Statesman).

<table>
<thead>
<tr>
<th>Table 1  Water Supply through the Canal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths</strong></td>
</tr>
<tr>
<td>• Reduces cost of water supply</td>
</tr>
<tr>
<td>• Easier to operate</td>
</tr>
<tr>
<td>• Load excavated from the canal used for</td>
</tr>
<tr>
<td>filling up the township, recycling the</td>
</tr>
<tr>
<td>earth</td>
</tr>
<tr>
<td>• Canal existing, so no laying of pipes</td>
</tr>
<tr>
<td>is required.</td>
</tr>
<tr>
<td>• No leakage here minimum of water loss.</td>
</tr>
<tr>
<td><strong>Weakness</strong></td>
</tr>
<tr>
<td>• Water contamination</td>
</tr>
<tr>
<td>• Silting of the canal</td>
</tr>
<tr>
<td>• Water supply disrupted during removal</td>
</tr>
<tr>
<td>of silt from the canal</td>
</tr>
<tr>
<td><strong>Opportunities</strong></td>
</tr>
<tr>
<td>• It will revitalize the Northern Canal</td>
</tr>
<tr>
<td>system</td>
</tr>
<tr>
<td>• Innovative method</td>
</tr>
<tr>
<td>• Will save lot of time</td>
</tr>
<tr>
<td>• Lot of legal problems and land</td>
</tr>
<tr>
<td>acquisition problems can be avoided</td>
</tr>
<tr>
<td>• Technology involved will be much simpler</td>
</tr>
<tr>
<td><strong>Threats</strong></td>
</tr>
<tr>
<td>• During dry season water in the canal</td>
</tr>
<tr>
<td>may get partially dried up</td>
</tr>
<tr>
<td>• Water poisoning</td>
</tr>
</tbody>
</table>
Surface water from river Hooghly, with proper quality and quantity will be supplied to the new town. The raw water intake point will be at Cossipore, through lock gate arrangement. As mentioned above initially it was decided that the water would be brought to the new town through pipeline. After reconnaissance survey two alignments were considered. The alignment of the first option (pipeline), though a little shorter, involved laying of the pipeline through very busy streets, narrow zigzag roads and crossing of a series of railways tracks such as Chitpur Railway Yard. The difficulties and costs involved in laying the pipelines are:

- Non availability of land;
- Other operational difficulties like rehabilitation of people on the proposed alignment; and
- Negating through Chitpur railway yard

The other option, which is being considered by the PHE (Public Health Engineers, Government of West Bengal) and the West Bengal Housing Infrastructure Development Corporation (WB HIDCO), is that the water should be brought through Kestopur canal flowing south of Rajarhat. 

Further, SWOT analysis done by the writers is being provided to compare the two options (see Table 1 and 2).

### 4.1 Present Condition of the Canal

According to the HIDCO, the Salt Lake Municipal Authority as well as the Irrigation Wing of the Government of West Bengal, the bed of Kestopur Canal proposed to carry water from the Hooghly River to Rajarhat is heavily silted and requires excavation up to a depth of 6 to 8 feet. The canal has to be dried up before the irrigation department can commence the work for removing silt. Moreover, the outflow from twenty drainage channels, into the canal has caused contamination with sewage as the canal is connected to about twenty percent of Salt Lake households, including the Central Reserve Police camp, Police Abasan (Housing) and Bidhan Abasan. These drainage channels are supposed to carry only storm water into the canal.

The work to segregate the domestic sewage from storm water will necessitate the identification and decoupling of the former and the task has been entrusted on Bidhannagar Municipal Corporation. The work involves de-linking the domestic sewage lines and redirecting the same through long pipes to Makalpota Khal, a tributary of Belliaghata Circular Canal via Dhapa lockgate pumping station. Further, a barrier needs to be erected between eastern drainage channel and Kestopur canal at Nayapatti to ensure that domestic and storm water discharge do not mix. As per estimates given by experts at the meeting held in Bidhannagar municipality on 17 November 2006, this diversion would cost about Rs 25 crores and will take about six months to complete the project.

After SWOT analysis Kestopur canal has been recommended to bring raw water to the Water Treatment Plant (WTP). It is proposed that connecting canal between Bagjola and Kesh topur (Pass Khal) is to be disconnected immediately. Immediately stopping wastes from Salt Lake sewer to fall into the canal as already noted.

### 4.2 Operations and Maintenance

- Until water is available from Hooghly River that is until the first phase of development of the
township is complete, it is important to guard against contamination of ground water by boring deep wells at a depth of 160-170 m below the ground surface;
• Urgent implementation of surface water scheme from Hooghly is required;
• Regular flushing of pipes to stop rusting of pipes within the township;
• Integrating water supply of existing settlements with water supply network of the new town;
• Occasional removal of silt from Kestopur Canal;

- Alternative arrangement of supply of water during removal of silt from the Canal. To continue water supply to the new town, it is proposed that the canal be divided into two channels, one narrow and one wide, so that the water supply can continue when silt is being removed from one section;
- Land management of the canal banks by planting fruit trees to stop unwanted squatter settlements and open defecation. Planting of fruit trees will preserve the canal bank while reducing pollution creating better environment and generating employment.

Fig. 2 CANAL NETWORK FOR WATER SUPPLY SYSTEM FOR RAJARHAT NEW TOWN

![Canal Network Diagram](image-url)
Fig. 3: Water Supply System
• Rain water harvesting to collect and use water for gardening, washing roads, etc;
• Guarding against pipeline leakage;
• Providing training to personnel in modern water treatment plant management;
• Loss of water through public stand posts must be checked;
• Separate account may be maintained for water supply operations and maintenance;
• Carrying out all maintenance and repair works;
• 20 percent of revenue collected to be kept aside for operations and maintenance costs;
• Calibration of water meters; and
• Early action to be taken for replacement of worn out mains for stopping leakages to minimize losses.

4.3 Cost Recovery
• Public private partnership to recover the cost of water. Floating of agency to formulate water pricing structure to collect water charges;
• Installation of water meters at appropriate locations;
• Variable water pricing for industrial, residential and commercial users; and
• Developing a Graded Water Tariff System to provide water through bulk supply to local bodies at Rs.3 per kilolitre, for housing societies and permanent houses at the rate of Rs.4 per kilolitre, industrial use for Rs.15 per kilolitre, and commercial use for Rs.10 per kilolitre.

4.4 Collection of Water Charges
• The private sector or contractor can be involved for collection of water charges on behalf of the Housing and Infrastructure Development Corporation or municipality;
• The private sector or contractor can be involved for the above network. The proposed final layout of the water distribution network is given in Fig. 3.

5. CONCLUSIONS
If we rejuvenate the North Canal System of Kolkata Metropolitan Area, things could improve. The North Canal System comprises of the Kestopur Canal, Bangur Kata Canal, Circular Canal and the Bagjola Canal. Lately, the Government has shown interest in revitalizing the North Canal System for a variety of uses such as drainage purposes, for carrying drinking water supply and for navigation. If properly planned and executed, excavating and rejuvenating the North Canal System will help solve some of the problems listed below:

• Re-excavating the Kestopur Canal and use it for bringing water to Rajarhat which has already been described above;
• Re-excavate the Bagjola Canal and use it for storm water drainage for the new township of Rajarhat, which will be a cost-effective and sustainable way;
• North canal system, if properly excavated, has the potential to provide low cost bulk movement and passenger movement within the KMA area. Once developed, it can connect the CBD of Kolkata with Rajarhat, new town. The canal will pass through Kestopur, Dum-Dum Park, RG Kar and Chitpur. Travel time from Rajarhat, new town to the CBD will be 50 minutes. It will be sustainable, cost-effective and non-polluting;
• Once the 43 km north canal system is re-excavated it can carry the drainage and effluent of KMA effectively to river Bidhyadhari (in South 24 Parganas) at Kultigong which finally discharges to river Hooghly near Sunderban; and
• Once the North Canal System of which Kestopur and Bagjola canals are integral part, becomes navigable, the waterway distance to Bangladesh will reduce from 275 km to 90 km giving a significant boost to tourism and trade.

Most importantly, besides solving sewerage and drainage problems of the Kolkata Metropolitan Area (KMA), the north canal system will partially solve the road congestion problem of Kolkata, reduce pollution and help in economic development of Sunderban and boost tourism in West Bengal.
Further, Rajarhat new town is going to take advantage of the Waste Recycling Region or WRR, which is adjacent to the new town for sewage disposal. The total area of the WRR is 3,500 hectares, of which the north Salt Lake basin with its immediate surroundings is about 1,375 hectares. It has been recommended for utilizing the WRR to discharge the effluent of township after primary treatment. The additional detention within the WRR would help towards self purification of the sewage. After that the effluent can be recycled into fisheries in the WRR. Thus, the Rajarhat town will take advantage of the available resources such as Kestopur Canal for bringing water from Ganga and WRR Zone for sewage disposal with an aim to make sustainable new town development by minimizing the costs.

REFERENCES

Call for Papers and News Items
The Editor requests members to send articles for inclusion in the Journal and Newsletter. Chairpersons and Secretaries of the various Regional Chapters and Committees of the Institute are particularly requested to send highlights of their activities for the Newsletter and articles for the Journal on a regular basis. Articles for the Journal may be sent as a soft copy (MS Word) as well as hard copy. Items for the Newsletter can also be e-mailed to: itpidel@nda.vsnl.net.in

Diagrams and sketches should be neatly drawn, labeled and sent as soft as well as hard copy.

Editor