Blueprint for water augmentation in Delhi, India

Area: 1,483 sq. km.
Population: 19 million

Background

The ‘Blueprint for Water Augmentation in Delhi’ was completed in January 1999. This was the first document which pointed out a comprehensive way for NCT Delhi to achieve water security by increasing reliance on its internal resource endowments. While there has been a broad-based agreement upon its premises and proposals, the implementation has been tardy owing to an over-emphasis on capital- and engineering-intensive approach by officials.

The NCT of Delhi, owing to its administratively confined landmass of some 1,483 sq. km., half of which is urbanized, presents a complex challenge to concept operationalization. The annual precipitation over NCT Delhi in volumetric terms comes to 900 million cubic metres (MCM) as against the projected annual requirement of 1,800 MCM, and it is a challenging objective to store the highest possible fraction of this precipitation in the limited and densely built-up land mass available. Satellite imagery, field surveys, historical data, old Survey of India maps, as well as hydro-geological mapping carried out by the Central Groundwater Board were employed at several sites of water harvesting in Delhi.

Strategies and Interventions

- **On-channel storage and recharge of storm water channels:** Several seasonal streams become activated during the monsoons, providing the outlet to floodwaters as well as local area runoff. A few major drains are those in Najafgarh, Mungeshpur, Bawana (all rural), and Kushak–Barapullah (which is an urban stormwater channel).
- **Off-channel storage for floodwaters**: On-channel storage can only hold around 20 per cent of stormwater. Therefore, Delhi requires additional storage space in the form of off-channel reservoirs. Sites for twelve such reservoirs have been identified.

- **Storage in lakes and depressions**: In urban areas, lakes have often been misused for dumping of solid waste and sewage disposal. Eighteen small and large lakes and depressions have been identified for development and enhancement of storage capacities.

- **Floodplain reservoirs for conjunctive extraction**: Very often the most copious freshwater aquifers underlie the floodplains. In urban areas, there is no place to store monsoon discharge of rivers. To overcome this difficulty partially, it is proposed that reservoirs be created on the floodplains by scooping out earth at appropriate locations and letting these reservoirs to be filled up by the expansive monsoon flows of the river. Thereafter, the waters can be extracted from the aquifer by a battery of shallow tubewells for a long duration in the lean season. Six sites covering 760 ha have been identified on the floodplains for this purpose.

- **Quarries**: Often, abandoned quarries are available in the vicinity of urban areas. With some shaping of their catchment area and linkage with some nearby channels, these can be used to store rain or floodwaters. Twelve major pits have been identified in Bhatti, Tajpur, Rajokri, etc.

- **Historical waterbodies**: In many urban areas, large historical reservoirs have fallen into disuse either by change of catchment characteristics or by destruction of the feeding channel in view of water scarcity, these reservoirs have a fresh relevance and need to be accordingly restored. Hauz Khas, Satpula, Mughal Tank (Narela) and several baolis have been identified under this component.

- **Check dams**: Wherever checkdams are possible according to local relief and regional topography, they should be built, taking caution not to use them for surface withdrawal but, instead, for recharging the falling water table.

- **Paleo-channels**: These are abandoned course of rivers or streams. Located through satellite imagery, paleo-channels serve as excellent groundwater recharge locations, and diversions of some of the monsoon flows into these channels greatly replenishes the declining water table for subsequent use. While a major paleo-channel has been located in west and north-west Delhi, coinciding with the main Mungeshpur drain, several paleo-channels have been located in and adjacent to the Yamuna floodplains.

- **Village ponds**: These are another endangered category owing to misuse and reclamation for ‘development purposes’. In general, as villages are absorbed into urban areas and with increasing reliance on tubewells, the ponds are becoming cesspools. It is recommended that suitable ponds be preserved, desilted and their water quality improved. The main purpose of ponds is to function as dispersed recharge structures. Field surveys have established the existence of 355 ponds in NCT Delhi and the creation of 15 additional ponds has been suggested—one in each rural growth centre.

- **Rooftop water harvesting**: At the level of campus or institutional establishments, rainwater falling on rooftops may be let to infiltrate into the ground through injection wells so as to impart a measure of sustainability to groundwater extraction. Several hundred institutions and other major built-up complexes have been identified for rooftop water harvesting.

- **Eco-parks**: Using aquatic root zone systems in combination with conventional treatment to treat sewage up to tertiary levels for recycling to the irrigation and horticultural sector, and possibly to the industrial sector, it is proposed that ecoparking techniques be employed in the existing and proposed 17 sewage treatment plants in the form of wetlands, and the recycled water be used in the proximity or even to recharge some confined aquifers.
The estimated quantity of increased water available in NCT Delhi at a level of 75% per cent dependability on rainfall have been tabulated below:

<table>
<thead>
<tr>
<th>Water harvesting component</th>
<th>Volume of water harvested (MCM)</th>
<th>Estimated annual recharge (MCM)</th>
<th>Cost incurred (Rs crore)</th>
<th>Cost incurred per MCM (Rs crore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage channels</td>
<td>107.77</td>
<td>29.67*</td>
<td>1092.04</td>
<td>7.94</td>
</tr>
<tr>
<td>Quarry reservoirs</td>
<td>8.87</td>
<td>-</td>
<td>4.5</td>
<td>0.50</td>
</tr>
<tr>
<td>Historical water bodies</td>
<td>0.35</td>
<td>-</td>
<td>2.026</td>
<td>5.78</td>
</tr>
<tr>
<td>Lakes and depressions</td>
<td>39.59</td>
<td>7</td>
<td>72.50</td>
<td>1.55</td>
</tr>
<tr>
<td>Checkdams</td>
<td>0.183</td>
<td>-</td>
<td>2.0</td>
<td>10.92</td>
</tr>
<tr>
<td>Village ponds</td>
<td>7.659</td>
<td>4.51</td>
<td>39.53</td>
<td>5.16</td>
</tr>
<tr>
<td>Floodplain reservoirs</td>
<td>11.14</td>
<td>30.4*</td>
<td>38.2</td>
<td>0.92</td>
</tr>
<tr>
<td>Rooftop harvesting</td>
<td>1.89</td>
<td>-</td>
<td>18.92</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>177.45</strong></td>
<td><strong>60.07</strong></td>
<td><strong>1,183.7</strong></td>
<td><strong>4.98</strong></td>
</tr>
<tr>
<td>Ecoparks (recycling)</td>
<td>803</td>
<td>-</td>
<td>175</td>
<td>0.22</td>
</tr>
<tr>
<td><strong>Grand total</strong></td>
<td><strong>980</strong></td>
<td><strong>71.58</strong></td>
<td><strong>1,358.7</strong></td>
<td><strong>1.30</strong></td>
</tr>
</tbody>
</table>

*Recharge additional to storage

Source: INTACH, blueprint for water augmentation in Delhi for Irrigation and flood control department.

The estimated cost of the engineering work and land acquisition is Rs 1,360 crore, which works to Rs 1.30 crore per MCM, as compared to an average of Rs 4 crore per MCM for water obtained from upstream Himalayan reservoirs.

Through water harvesting, 50 per cent (150 million gallons per day) of the projected domestic demand supply gap of 300 MGD can be met. In addition, the entire irrigation and horticultural demand can be met through recycled water, thus releasing groundwater for use in the domestic sector. Water harvesting, combined with higher treatment of recycled water and plugging of line losses, would eliminate in to the demand–supply gap by the year 2021.
The headway achieved so far is as follows:

1. In 1999, the stretch of outfall drain no. 8 (upstream of Najafgarh Jheel) from Dhansa Regulator to Jhatikra, a stretch of 5 km was desilted to hold stormwaters. This resulted in perennial submergence of this reach with the freshwater recharge diluting the brackish groundwater of the area and enabling resumption of farming operations.

2. In 2002, rainwater harvesting by-laws were passed, making rainwater harvesting mandatory for institutions and plotted houses over 500 sq m in area. This trend has continued ever since with flyovers and metro stations being brought under the ambit of the by-laws.

3. The revival of the Hauz Khas lake was an exemplary project which not only revived the dry 16 acre lake but demonstrated the efficacy of large-scale rainwater harvesting through waterbodies and also the possibility of recycling treated wastewaters through groundwater recharge from the bed of the lake. The treated wastewaters were sourced from Vasant Kunj STP and treated with aquatic plants (duckweed blanket) in check dams in the Sanjay Van. In 12 years, approximately 1,200 million litres of groundwater recharge has been achieved, raising the local water table.

4. The INTACH report also brought a focus on ponds and waterbodies in Delhi. Many exercises were undertaken to establish the numbers, locations, and sizes of the waterbodies and the last one carried out by INTACH in 2015 shows that 450 waterbodies are still feasible in Delhi. The model of Hauz Khas lake is now sought to be implemented by the authorities in several waterbodies across Delhi.

5. The INTACH report also identified the role of exhausted quarries in the Bhatti mines area in storing rainwater as well as highly treated (tertiary level) domestic effluents from nearby STPs for groundwater recharge as well as decentralized supply in south Delhi. A feasibility report has been recently completed by Water and Power Consultancy Services Limited.

6. The use of the stormwater network for groundwater recharge is also under consideration and a feasibility report has been commissioned for the north-western recharge network by Delhi Jal Board.

7. Work is on-going for the revival of Sanjay lake (East Delhi), using bio-remediated secondary level effluents from Kondli STP. The bio-remediation aspect would use a baffle reactor (already built) and a linear constructed wetland (3 m x 500 m). On similar lines, a management plan for Bhalaswa lake has also been drawn up.

8. The proposals and sites for water bodies identified in the INTACH blueprint were also marked in Master Plan 2001 and zonal plans (as well as NCR Regional Plan 2011) as areas of conservation important for groundwater recharge.

9. A floodplain reservoir north of Wazirabad has been taken up and implemented by Delhi Jal Board after consulting Central Groundwater Board regarding its potential and the battery of tubewells installed for extraction to augment water supply in the capital.

10. The influence of this project can be gauged from the fact that the Master Plan of Delhi 2001 clearly states that waterbodies above 1 ha area and drainage channels are to be preserved. Nodding to the report, the Plan also emphasizes recycling of water resources.

11. NCR Regional Plan 2021 also incorporates the need to preserve paleo-channels, oxbow lakes, waterbodies, and drainage channels.

12. Several cases have come up in courts to preserve individual waterbodies across the NCR and it has become much more difficult to eliminate waterbodies and reclaim them compared to the pre-2000 situation.

Source: INTACH, Blueprint for Water Augmentation in Delhi for irrigation and flood control department.

Additional/ Further information:
