Chapter 13

WATER SUPPLY AND SANITATION

1.1 Delhi is situated on the banks of the river Yamuna. The river Yamuna flows from north to south. A hard rocky ridge running from the Southern border of NCT in the south west in a north easrterly direction to the western banks of the river Yamuna near Wazirabad barrage forms the main watershed in NCT of Delhi. The topography created a drainage system that carries rain and storm water from the higher elevations of the West to the Yamuna. The eastern low-lying side was originally part of the flood plain of the river and considered unhabitable. Today however this Eastern wing, also known as the Trans Yamuna area, houses about 23% of the total population of Delhi.

1.2 The (hydro) geological situation is characterized by the occurrence of alluvial and hard rock formations and controls the groundwater availability in the territory. The quality of the groundwater in the hard rock formation in Delhi is generally potable, whereas in the alluvial formation groundwater, the water quality deteriorates with depth. Hard rock formation is found to be in North East-South West to North North East-South South West with steep dips towards South East and East. During 1960-2001, ground water levels were observed to have declined by 2-6 m in most parts of the alluvium areas. A decline of 8-20 m is recorded in Najafgard Block and in Mehrauli Block the decline is 8-35m.

1.3 A study found that groundwater levels in the north of Delhi and along the Yamuna River are within 1 to 2 metres of the surface. In the south, especially where there is significant groundwater abstraction, water levels are tens of metres below ground level. It can therefore be expected that infiltration into the sewerage system is higher in the north and in sewers along the Yamuna River.

1.4 Large-scale groundwater withdrawal for domestic, irrigation, and industrial purposes has resulted in a widespread decline of ground water table. Moderate to highly saline-water suggests that the amount of rainfall recharge is very limited and that groundwater flushing is incomplete. The ground water levels have declined with the additional problems of brackishness and pollution due to the tremendous abstraction. Brackish

ground water is found in Kanjhawala, Najafgarh and Bhalaswa, Burari and Dheerpur at shallow depths. Minor patches of brackish water are found in Alipore and City Blocks.

2. WATER CONSUMPTION

2.1 DJB supplies treated water in bulk to the NDMC (New Delhi Municipal Council) and to the DCB (Delhi cantonment Board), both of which are responsible for the distribution of this water within their own territories. The water supply infrastructure in these territories is owned by them and, consequently, is not the responsibility of the DJB. MCD area is the responsibility of DJB.

2.2 The 2001-02 water production by the DJB was 2911 mld (640 MGD) with water obtained from a range of sources such as river Yamuna, Bhakra storage, Upper Ganga Canal and from underground water resources. The distribution of this produced water is as follows:

Statement 13.1

<table>
<tr><td rowspan="11">System Input Volume</td><td rowspan="4">Authorised Consumption 58%</td><td rowspan="2">Billed Authorised Consuption</td><td>Billed Metered Consumption (including water exported in bulk)</td><td>13%</td><td rowspan="2">Revenue Water 50%</td></tr>
<tr><td>Billed Unmetered Consumption</td><td>37%</td></tr>
<tr><td rowspan="2">Unbilled Authorised Consumption</td><td>Unbilled Metered consumption</td><td>0%</td><td rowspan="9">Non-Revenue Water (NRW) 50%</td></tr>
<tr><td>Unbilled Unmetered Consumption</td><td>8%</td></tr>
<tr><td rowspan="7">Water Losses 42%</td><td rowspan="2">Apparent Losses 2%</td><td>Unauthorised Consumption</td><td>2%</td></tr>
<tr><td>Metering Inaccuracies</td><td>0%</td></tr>
<tr><td rowspan="5">Real Losses 40%</td><td>Leakage on Transmission Mains</td><td>16%</td></tr>
<tr><td>Leakage and Overflows at Utility’s Storage Tanks</td><td>0%</td></tr>
<tr><td>Leakage on Distribution Mains and Service Connections upto Point of Customer Metering</td><td>24%</td></tr>
</table>

Source: Delhi Water Supply & Sewerage Project Preparation Study Report

2.3 The total number of private tube wells (domestic, commercial and industrial) in Delhi is estimated at around 200,000. In addition to private tube wells, there are supplies of bottled water as well as numerous hand pumps. No consumption figures are available for hand pump and bottled water supplies. The willingness-to-pay survey carried out under a study project estimates that 23% of the households use such sources for at least part of their water requirement.

2.4 According to DJB data for 2001-02, 1498 TCMD (330 MGD) water was distributed and charged to various categories of customer as follows:

Statement 13.2

Category	**No. of Connections 2001-02**	**Sales**			**Percentage of Sales**	
		2001-02		**2003-04**	**2001-02**	**2003-04**
		TCMD	MGD	MGD		
Domestic	1,331,820	1124	247	245	75%	77.28%
Commericial and institutional	52,623	157	34	27	10.5%	8.54%
Industrial	10,876	59	13	07	4%`	2.20%
Bulk supplies to DCB and NDMC		158	36	34	10.5%	10.72%
Fire Fighting				04		1.26%
Total		1498	330	317	100	100%

The above supplied quantities, except the bulk supplies, are mostly estimates (see "Metering and customer connections" below)

In addition, the following free, non-metered supplies are given by DJB:
Standposts (11,533 no.); 221 TCMD (49MGD) (consultant's estimation)
Water tankers (493 no.); 10 TCMD (2 MGD) Consultant's estimation)

3. WATER REQUIREMENT

3.1 Based on a norm of 60 gallon per capita per day as per CPHEEO norms prescribed in MPD 2001, the water requirement for 2003-04 would be 900 MGD. As per CPHEEO

manual, the per capita per day water requirement is 60 GPCD as per details given in the Statement No.13.3.

Statement No.13.3

PER CAPITA PER DAY WATER REQUIREMENT - CPHEEO NORMS

1.	Domestic	172 lpcd
2.	Industrial, Commercial and Community requirement based on 45000 litres per hect. per day	47 lpcd
3.	Fire protection based on 1% of the total demand	3 lpcd
4.	Floating population and special uses like hotel	
	and Embassies	52 lpcd
	Total	274 lpcd (60gpcd)

4. WATER SUPPLY TARGETS 2004-05

Delhi Jal Board has proposed to increase the Water Supply capacity from 650 MGD as on 31.03.04 to 850 MGD as on 31.03.2005 as per details given below:

Statement No.13.4

WATER SUPPLY CAPACITY

S.No.	Name of Plant	Existing Capacity as on 31.03.2004 (MGD)	Proposed Capacity at the end of 31.03.2005. (MGD)
1.	Chandrawal Water House no. I & II	90	90
2.	Wazirabad I,II & III	120	120
3.	Haiderpur	200	200
4.	North Shahadra (Bhagirathi)	100	100
5.	Bawana		20
6.	Nangloi	40	40
7.	Sonia Vihar	--	140
8.	Renney Wells and Tube Wells	81	90
9.	Optimization of WTPs	19	40
10.	Recycling of Waste water at Chandrawal,	10	
	Bhagirathi, Haiderpur and Wazirabad		
	Total	650	850

5. WATER RESOURCES

5.1 The water supply treatment plants of DJB treat 569 MGD surface water and 81 MGD ground water as on March, 2004. The water resources of DJB are indicated in Statement No.13.5.

Statement No.13.5

WATER RESOURCES OF DJB

Sl.No.	Source	Quantity (MGD)
1.	Yamuna	229
2.	Ganga	100
3.	Bhakra Storage	240
	Subtotal (Surface Water)	569
4.	Ranney Wells/Tube Wells (Ground water)	81
	Total	650

GROUND WATER

5.2 The decreasing ground water level in Delhi has become a matter of serious concern. At some places in south and south west Delhi, the water level has gone below the 20-30 meter mark below the land surface. The quality of underground water is deteriorating and in several places it has been found to be unfit for human consumption. The salinity of ground water is increasing in south-west and north-west Delhi. In some areas of Shahdara and Kanjhawala, nitrate content has been found to be more than 1000 mg/litre. Fluoride and chemical concentrations, more than prescribed limits, have also been found in ground water at various locations in Delhi (Table No.8.7). To tackle these problems, the Central Ground Water Board has taken steps to regulate the number of tube-wells being commissioned in Delhi.

5.3 As on March 2004, DJB has 2334 Tubewells and 21 Ranney Wells. The Flood prone area upstream of Wazirabad barrage is being exploited for commissioning of more tube wells by DJB. The deepening of the Najafgarh drain between Kakrola and Dhansa

Regulator, preserving and developing old lakes and other water bodies, preserving and developing the forest area in Delhi, construction of check dams at Asola Wild Life Sanctuary and plantation of trees, are some of the steps being taken to improve ground water resources.

5.4 A beginning has also been made towards harvesting roof top rain water and waste water re-cycling in Delhi. PWD and DJB has already started rain water harvesting measures in Govt. office buildings. Cooperative Group Housing Societies are also being persuaded to adopt rain water harvesting in their complexes. Building bye-laws have also been amended to ensure rain water harvesting measures in all new buildings with 1000 sq. meter and above size plot area.

SURFACE WATER
A PARALLEL CHANNEL FROM MUNAK TO HAIDERPUR

5.5 About 30% of the raw water discharged from Tajewala headworks is lost in the present water carrier system through the Yamuna river and the Western Yamnua Canal system. To prevent this loss, construction of a parallel pucca channel is under construction from Munak to Haiderpur. This channel is being constructed by the Haryana Government. After a lot of persuasion, the Government of Haryana has started construction of this pucca channel of 102 kms length. The estimated cost is Rs. 314.15 crore and it will be completed in March, 2006 The entire cost of the project will be financed by Delhi Govt. Water availability will increase by 80 MGD on construction of this channel.

RESERVOIRS

5.6 Renuka Dam, Kishau Dam and Lakhwar Vyasi Dam are proposed to be constructed so that Delhi gets its share in Yamuna water as per Yamuna Water Sharing Agreement signed in May, 1994. About 275 MGD of water will be available to Delhi from Renuka Dam. Delhi will also get 372 MGD water from Kishau reservoir and 135 MGD from Lakhwar Vyasi reservoir (Map 13.1).

5.7 About 300 cusecs of raw water will be available for Sonia Vihar plant from Tehri Dam. To carry this raw water a 3250 mm dia conduit is being laid from Murad Nagar to Sonia Vihar through UP Jal Nigam at an estimated cost of Rs 110.00 crore. This work is also likely to be completed shortly.

6. NEW WATER TREATMENT PLANTS

6.1 A 40 MGD Water Treatment Plant was constructed at Nangloi but it could not function to its full capacity as raw water for this plant is not available; at present it is functioning at 24 MGD capacity only . Another new water treatment plant of 20 MGD at Bawana is likely to be commissioned in 2004-05.

6.2 Construction of 140 MGD Water Treatment Plant at Sonia Vihar at an estimated cost of Rs 330.00 crore will be completed by October, 2004.

6.3 Two new Water Treatment Plants are proposed to be commissioned at Dwarka (40 MGD) and Okhla (20 MGD) during the 10th Five Year Plan. Raw water for the two plants will be available on construction of the pucca parallel channel from Munak to Haiderpur.

7. WASTE WATER MANAGEMENT

7.1 Due to the continuous inflow of migrants and the mushrooming growth of unauthorized colonies and JJ clusters, the landscape of Delhi is spotted with different types of settlements. More than 45% population is residing in such unplanned settlements where sewerage system is not provided. The estimated waste water generation in Delhi in January, 2000 and the population served with sewerage system may be seen at Table No.13.2. Now, plan schemes to provide sewerage systems in regularised-unauthorised colonies, JJ resettlement colonies, and urbanised villages, are being implemented and the present status of these colonies may be seen at Table 13.4. DUEIIP-2021 projections for waste water generation in Delhi in 2021 are indicated in Statement No.13.6.

Statement No.13.6

WASTE WATER GENERATION IN DELHI IN 2021

• Predicted population in 2021	=	220 lakh
• Total water demand (excluding losses)	=	4370 mld
• Total wastewater generation (assumed at 80% of demand)	=	3600 mld
• Wastewater going to STPs*	=	3600 mld
• Wastewater going to CETPs*	=	350 mld

* ignores any local recycling and reuse of wastewater, etc., but allows for future transfer of some existing industries in non-conforming areas to conforming areas

7.2 The Consultant for World Bank funded "Delhi Water Supply & Sewerage Project" estimated 5259 MLD water supply requirement for Delhi in 2021 and waste water generation from this level of water supply will be about 3760 MLD as per statement No. 13.7.

STATEMENT NO. 13.7
PREDICATED SEWAGE FLOWS

Sources of wastewater	**Volumes, mld**				
	2004	2005	2006	2011	2021
Total water demand	2685	2800	2917	3573	5259
Total net water supply	2265	2362	2461	3573	5259
Wastewater generated	1812	2240	2334	2858	4207
Treated at CETP	200	217	234	346	755
Proportion not sewered	14%	13%	13%	10%	5%
Outside sewered area	254	302	302	294	210
Net generated wastewater	1358	1722	1798	2218	3242
Infiltration	518	518	518	518	518
Gross wastewater to treatment	1876	2240	2316	2736	3760

7.3 SEWAGE TREATMENT CAPACITY

The sewerage treatment capacity of DJB has been increased from 402.4 MGD as on 31.3.2001 to 512.40 MGD by March, 2004 as per details given below:

Statement No.13.8

SEWAGE TREATMENT CAPACITY

SN	Name of STP	Capacity (MGD) as on 31.3.2001	Capacity (MGD) by 31.3.2004	Actual treatment in MGD as on 31.3.04
1.	Okhla	140	140	123.13
2.	Keshopur	72	72	71,07
3.	Coronation Pillar	40	40	30.41
4.	Rithala	40	80	48.07
5.	Kondli I, II, III, IV	45	45	35.90
6.	Yamuna Vihar I, II	10	20	10.29
7.	Vasant Kunj	5	5	3.61
8	Ghitorni	5	5	---
9.	Pappankalan	20	20	15.00
10.	Narela	10	10	0.50
11.	Najafgarh	5	5	0.20
12.	Delhi Gate	2.2	2.2	2.44
13.	Sen Nursing Home	2.2	2.2	2.45
14.	Rohini	---	15	15.00
15.	Timarpur	6	6	---
16.	Nilothi	--	40	4.44
17.	Mehrauli	--	5	0.75
	Total	402.4	512.40	348.26

7.4 These STPs are not functioning up to their full installed capacity due to various reasons such as low flow of sewage to STPs, trunk and peripheral sewer lines still to be connected to STPs, etc. The sewage generation at present is estimated to be around 420

MGD and treatment is around 350 MGD only. This untreated sewage (70 MGD) falling in river Yamuna is the major cause of river pollution.

7.5 DJB has a network of branch, peripheral and trunk sewers of about 6000 kms length out of which 130 kms is trunk sewers. About 71 kms of trunk sewers require immediate desilting and rehabilitation as this part is settled and silted. The status of Trunk Sewers may be seen at Table No.13.5.

WASTE WATER REUSE

7.6 The main opportunities for reuse of treated wastewater in and around the city are considered to be irrigation and horticulture. There is also some demand for use as cooling water in the power stations. Other options include groundwater recharge, return to the raw water source, and the treatment and reuse of sullage water, i.e. water that does not contain human excreta, for flushing toilets, etc.

7.7 Presently DJB supplies about 138 MGD of treated wastewater to the Irrigation Deptt. This is discharged directly to the irrigation channels from the sewage treatment plants. 1,160 Mld (approx.) is available for reuse in some way.

7.8 A number of small effluent reuse projects are in the planning or implementation stages. They comprise horticultural, irrigation and industrial uses, and will use up to 46 MGD (210 Mld).

7.9 DDA is responsible for 4,451 hectt. of open spaces, all of which are irrigated via tubewells. There is also irrigation of MCD open spaces, central government properties, private parks and properties, road verges, sports stadiums, etc. The details of the green areas being maintained by the various agencies is indicated in Statement No.13.9.

Statement 13.9

AGENCY-WISE GREEN AREA

Agencies	Green Areas(in Hectare)
NDMC	445
MCD	2,428
DDA	4,451
CPWD	2,200
FOREST Department	11,000
Total	20,524

Source : DUEIIP-2021