Sewage Management in Delhi

This performance audit is the fourth in the series of performance audits carried out by Audit on issues relating to sewage management and treatment aimed at controlling water pollution in the National Capital Territory (NCT) of Delhi. The earlier three reviews printed in the Reports of the Comptroller and Auditor General of India relating to the Government of NCT of Delhi and presented to the Legislature during 2000, 2004 and 2005, highlighted *inter alia* the slow progress of construction of sewage treatment plants (STPs) and sewage pumping stations (SPSs), rehabilitation of sewer lines, tardy progress of construction and utilisation of common effluent treatment plants (CETPs) to treat industrial effluents and continuing flow of large quantities of industrial and domestic sewage into the storm water drains without treatment.

In view of the significant under performance of sewage treatment projects, this performance audit was carried out with a view to assessing the management of the STPs, SPSs and connecting sewer lines as well as actual treatment of industrial and domestic sewage alongwith quality of treatment.

2.1.1 Introduction

The Delhi Jal Board (DJB) provides sewage facilities in areas under the jurisdiction of the Municipal Corporations of Delhi (MCsD). The New Delhi Municipal Council (NDMC), Delhi Cantonment Board and Delhi Development Authority (DDA) are responsible for construction of branch sewers and outfall into trunk sewers in the areas under their respective jurisdiction. The DJB would collect sewage only in bulk from the areas falling within the jurisdiction of the NDMC and the Delhi Cantonment Board, Military Engineering Services. The DJB is the executing agency entrusted with the construction and maintenance of STPs, SPSs, trunk sewers and collection and treatment of domestic sewage in the NCT of Delhi and bulk sewage of NDMC and Cantonment areas. The DJB has a capacity of 543.4 MGD of sewage treatment and total sewage generated in NCT Delhi is 680 MGD. The DJB is able to collect and treat only 367 MGD of sewage and the rest 313 MGD of sewage is discharged untreated into River Yamuna.

The Delhi State Industrial Infrastructure Development Corporation (DSIIDC) is entrusted with the task of constructing Common Effluent Treatment Plants (CETPs) in identified industrial estates. Different industrial estates house a large number of small and medium scale industrial units. In 1996, a PIL was filed in the Supreme Court of India, against the Government of India, requesting intervention of the Hon'ble Supreme Court for controlling industrial pollution in Delhi. The Hon'ble Supreme Court, concerned with the problem of environment, directed (February 1996) the Government of NCT of Delhi to construct CETPs to treat effluent of industrial units located in 28 different Industrial Estates of Delhi. The DPCC entered into an agreement

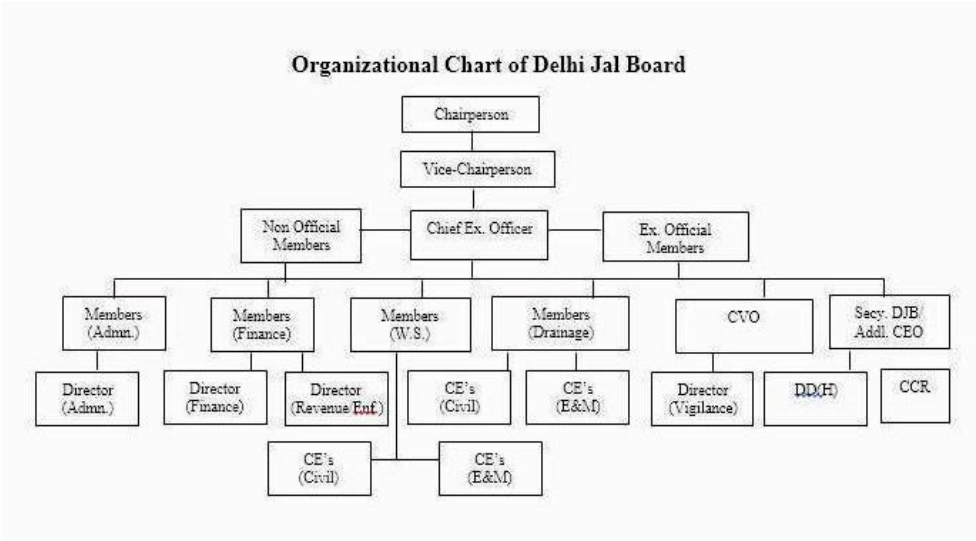
(March 1996) with National Environmental Engineering Research Institute (NEERI), to conduct a survey and suggest the measures to be adopted for treating industrial waste. The NEERI, in its report (June 1996) suggested establishment of 15 CETPs to cover 21 Industrial Estates of Delhi.

The DPCC and the Central Pollution Control Board (CPCB) are responsible for monitoring of pollution and enforcement of pollution standards.

An entry conference was held on 5 July 2012 and exit conference was held on 6 March 2013.

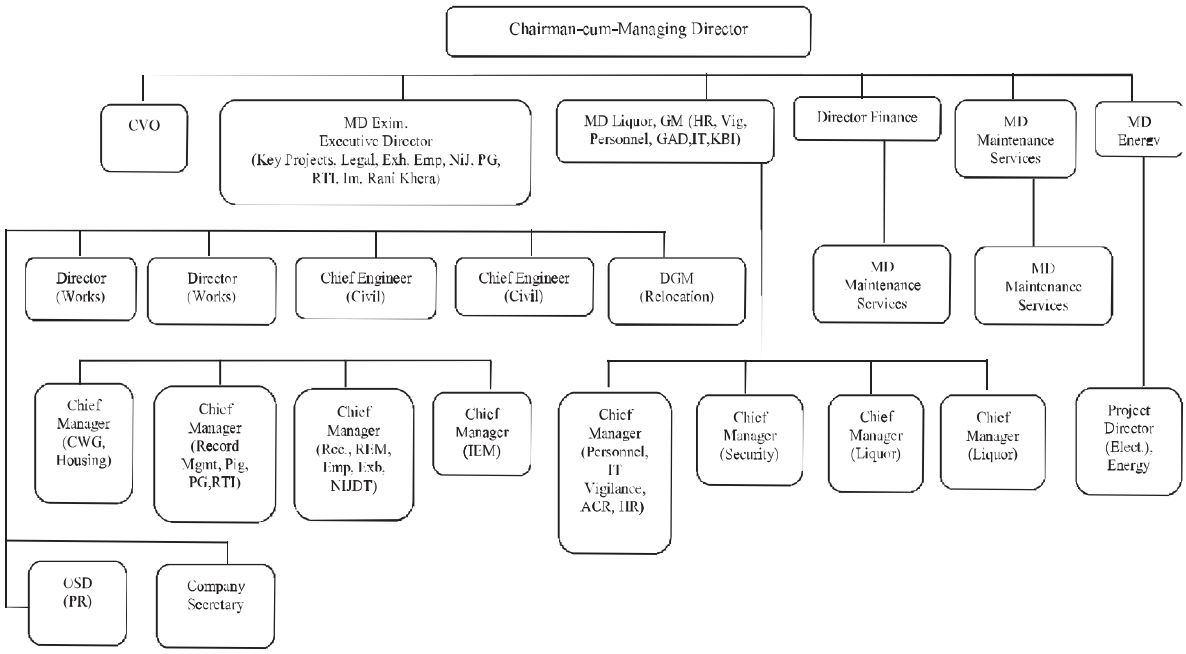
2.1.2 Organiasational set up

The DJB is headed by the Chairperson. There is one Vice Chairperson, one Chief Executive Officer, one non-official member, one executive official member, four members (Administration, Finance, Water Supply and Drainage), three Directors, six Chief Engineers (for Drainage), Superintending Engineers, Executive Engineers, Engineering staff and Zonal Revenue Officers.



2.1.2.1 Delhi State Industrial and Infrastructure Development Corporation

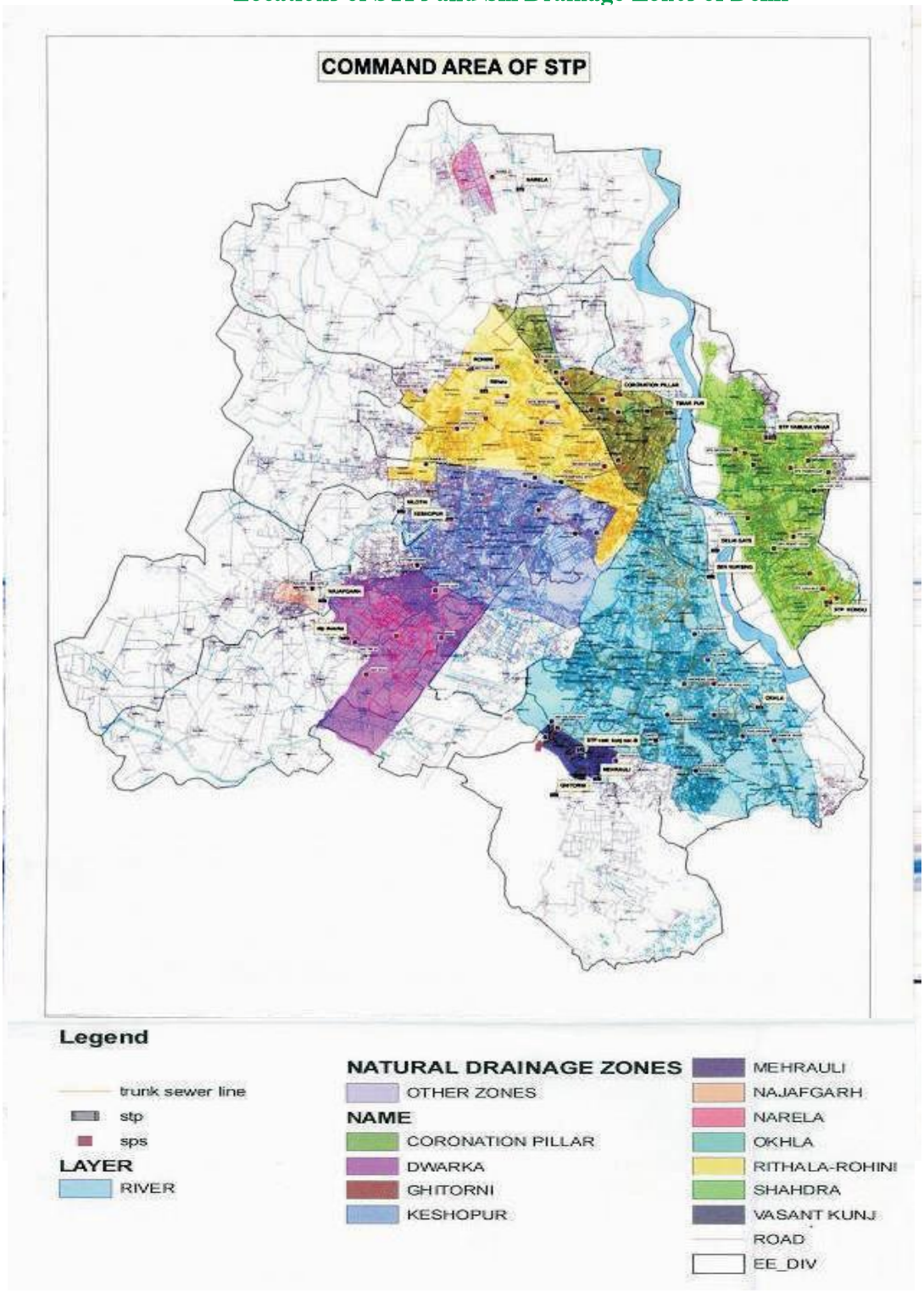
The DSIIDC is headed by a Managing Director. There is one Chief Engineer, one Chief Project Manager (E&M), one SPM (E&M), one Project Manager and one Manager for CETPs.



2.1.3 Existing sewage system in Delhi

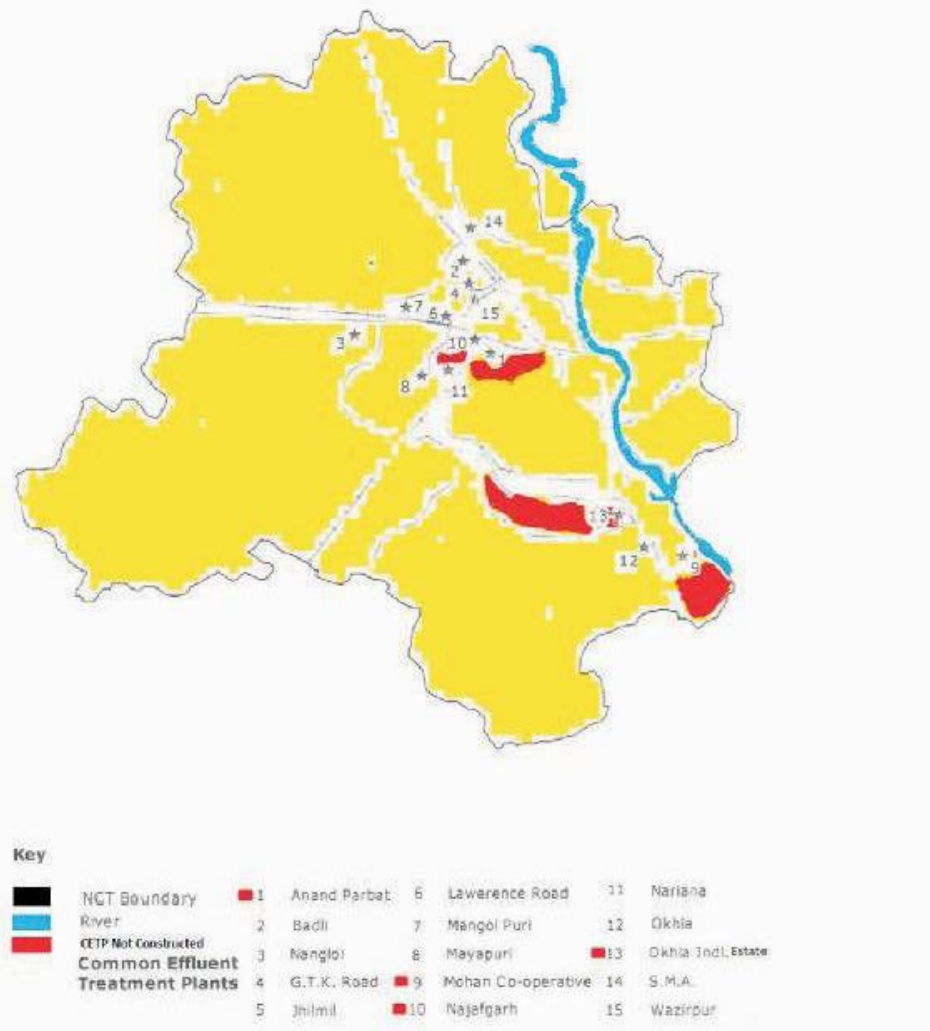
The DJB has 31 STPs at 18 locations in NCT of Delhi along with 42 SPSs. The sewage network comprises of 6500 kms of sewer lines including branch sewers (peripheral/ internal sewers). This includes 29 main trunk sewers of total length of 150 km and about 1500 km of peripheral network. For sewer management, Delhi is divided into six drainage zones of Okhla, Keshopur, Rithala-Rohini, Coronation Pillar, Shahadra and Outer Delhi. The locations of STPs and six drainage zones are depicted in the map:

Locations of STPs and Six Drainage Zones of Delhi



Out of 15 CETPs, as recommended by NEERI, the DSIIDC had constructed and made functional 11 CETPs, leaving four at Anand Parbat, Mohan Cooperative, Badarpur-Okhla and Najafgarh Road Industrial Estates. Apart from these, DSIIDC had constructed two more CETPs at Narela and Bawana, as these industrial estates came subsequent to NEERI Report. The estimated cost of construction of 15 CETPs was ₹ 256 crore. The location of 15 CETPs is depicted in the map below:

Locations of CETPs of Delhi



2.1.4 Audit objectives

The performance audit was conducted to verify whether:

- there was a gap between sewage generation, sewage treatment capacity and actual sewage treatment by the DJB and DSIIDC,
- the programs and schemes for sewage system in Delhi were conceived and systematically planned for treatment of sewage,
- the funds available for the sewage system were optimally utilized,
- the facilities created were effectively functioning in accordance with the stipulated performance standards,
- there was an effective system for monitoring the quality of the effluent water so as to enable timely corrective measures and the measures taken had impact in improving the quality of effluent water.
- the CETPs were handed over to respective CETP societies after completion.
- all the industrial areas were covered for collection of industrial sewage for treatment at CETPs, and
- the sludge generated was being disposed off properly,

2.1.5 Audit criteria

The performance of the DJB in sewage management was benchmarked against the criteria drawn from the following:

- The Sewage Manual of the Ministry of Environment and Forest, GOI,
- The General Financial Rules and other orders issued by the Government,
- The CPWD Works Manual,
- Guidelines and instructions issued by the Environment Pollution (Prevention and control) Authority (EPCA) and the Delhi Pollution Control Committee, and
- Guidelines and instructions issued by the Hon'ble Supreme Court of India.

The performance of the DSIIDC in industrial sewage management was benchmarked against the criteria drawn from the following:

- Hon'ble Supreme Court orders,
- EPCA/ DPCC survey reports,
- Report of NEERI, and
- Handing over/taking over documents of CETPs etc.

2.1.6 Scope of audit and methodology

The performance audit was conducted during August-November 2012 covering the period from April 2007 to March 2012 by examining the records relating to the Sewage Management in Delhi and test check of records of DJB and DSIIDC. The audit team also examined records maintained by STPs located at seven sites along with the connected SPSs and CETPs in Wazirpur, Badli, Jhilmil, Nangloi and Okhla Industrial Area and Delhi Pollution Control Committee and Central Board of Pollution Control.

For the purpose of audit, STPs at seven locations were selected through Statistical Random Sampling without Replacement (SRSWR). Audit sample was 100 *per cent* for STPs with capacity of more than 70 MGD (three), 40 *per cent* for STPs with capacity from 20 to 70 MGD (two) and 30 *per cent* for STPs with capacity less than 20 MGD (two) along with their SPSs. Out of 40 construction and sewage maintenance divisions of DJB, eight divisions (20 *per cent*) were selected through SRSWR viz. four from maintenance divisions and four from construction divisions.

The performance audit with reference to scheme for Sewage Management in Delhi was conducted in the DSIIDC covering a period of 2007-12 to examine its role and responsibility in operationalisation of CETPs. Five CETPs i.e. Wazirpur, Badli, Jhimil, Nangloi and Okhla Industrial Area were selected for detail audit.

2.1.7 Audit findings in Delhi Jal Board

2.1.7.1 Utilisation of funds

The DJB prepares its budget in two parts (i) Non-plan/ Revenue budget (ii) Plan/ Capital budget to separate operating expenses from capital expenses. The main items of capital receipts are loan and grants-in-aid from the Department of Urban Development, Government of NCT of Delhi; funding from Central Government schemes like Jawahar Lal Nehru National Urban Renewal Mission (JNNURM) and Yamuna Action Plan (YAP). During the period between April 2007 and March 2012, the Government released ₹ 2952.19 crore to the DJB for creation of sewage treatment facilities, of which, the DJB utilized ₹ 2714.8 crore (91.96 *per cent*). Details of outlay,

actual expenditure and unspent balance for 2007-12 are given in **Table 2.1.**

Table 2.1: Details of outlay, actual expenditure and unspent balance for 2007-12

(₹ in crore)

Year	Outlay				Expenditure			
	Bulk	Construction	Maintenance	Total	Bulk	Construction	Maintenance	Total (%)
2007-08	89.00	183.30	79.15	351.45	128.14	132.09	66.40	326.63 (92.92%)
2008-09	82.63	283.75	138.40	504.78	122.17	221.23	85.68	429.08 (85%)
2009-10	117.25	470.24	47.25	634.74	153.88	460.25	50.67	664.80* (104.74%)
2010-11	123.45	396.81	56.62	576.88	146.03	476.53	54.57	677.13 (117.38%)
GIA*	0	161.48	0	161.48	0	0	0	0
Total 2010-11	123.45	558.29	56.62	738.36	146.03	476.53	54.57	677.13 (91.71%)
2011-12 (Provisional)	133.20	274.33	90.34	497.86	174.79	233.19	98.29	506.27 (101.69%)
GIA*	0	225.00	0	225.00	0	110.89	0	110.89 (49.28%)
Total 2011-12	133.20	499.33	90.34	722.86	174.79	344.08	98.29	617.16 (85.38%)
Total	**545.53**	**1994.91**	**411.76**	**2952.20**	**725.01**	**1634.18**	**355.61**	**2714.8 (91.96%)**

** Grant-in-aid received under JNNURM*

A: Bulk includes the expenditure on maintenance of SPSs and STPs

B: Construction includes expenditure incurred on construction of STPs, SPS and Sewer Lines

C: Maintenance includes the expenditure incurred by the maintenance divisions on sewer lines

The expenditure of ₹ 1634.18 crore during the years 2007-12 was on construction of STPs, SPSs and Sewer lines in MCsD areas. The DJB added only one MGD capacity of STP and 900 Kms of sewer lines between 2007-12.

The DJB's utilization of planned outlay ranged between 85 *per cent and 117 per cent* during 2007-12. The extent of under utilisation of the Grants-in-aid under JNNURM received during 2010-11 and 2011-12 was 100 *per cent* and 51 *per cent* respectively. The budget provision under YAP-II for the year 2009-10 was ₹ 66.19 crore whereas the actual expenditure was ₹ 106.37 crore.

The DJB stated (March 2013) that the scheme wise fund was released by the Government and was re-appropriated in revised estimate on the basis of expenditure likely to be incurred upto the end of the financial year. But in

some cases even after completion of the work, the bills are received in the beginning of next financial year. The reply was not acceptable in terms of Rule 52 (2) of the General Financial Rules which states that a Grant or Appropriation can be utilised only to cover the charges to be paid during the financial year of the Grant or Appropriation and adjusted in the account of the year.

2.1.7.2 Planning

For the proper functioning of any organization, a perspective plan containing proposed activities of the organization in the coming years is of paramount importance to ensure swift and smooth discharge of its mandatory function. A city five year plan for sanitation is a living document that details the steps the civic body needs to undertake to ensure universal access to sanitation for all its citizens. Sanitation involves collection, treatment and disposal of sewage/ sludge in an economic, environmental friendly and sustainable manner. However, no such perspective plan for sewage management was prepared by the DJB for XIth five year plan (2007-12).

(a) Under utilisation of STPs

The location, capacity and actual utilisation of seven test checked STPs for last five years (2007-12) are detailed in **Table 2.2.**

Table 2.2: Location, capacity and actual utilisation of test checked STPs

Sl. No.	Location	No of STP	Installed capacity(MGD)	Sewage actually treated (MGD)	Capacity utilisation (*per cent*)
1.	Okhla	5	170	113.07	66.51
2.	Rithala	2	80	43.01	53.76
3.	Keshopur	3	72	23.10	32.08
4.	Rohini	1	15	0.73	4.87
5.	Yamuna Vihar	2	20	11.53	57.65
6.	Narela	1	10	1.20	12.00
7.	Pappankalan	1	20	13.45	67.25
	Total	**15**	**387**	**206.09**	**53.25**

As can be seen, all these STPs were working below capacity and overall utilisation was only 53 *per cent* of the total capacity. The capacity utilization at Rohini and Narela was as low as five and 12 *per cent* respectively. The DJB spent large amounts in creating treatment capacity in sparsely populated areas while it failed to create necessary treatment facilities and conveyance systems in areas where large quantity of sewage was being generated. Reason for such

low capacity utilization was mismatch between the treatment capacity created and the actual sewage generated in the relevant catchment areas.

A view of Rithala Phase-II, STP

(b) Construction of treatment plants in low sewage load areas

The DJB incurred an expenditure of ₹ 54.46 crore on creation of sewage facility where sewage generation was low as given in **Table 2.3.**

Table 2.3: STPs in low sewage load area

	Ghitorni	Rohini	Narela	Pappankalan	Total
Treatment capacity created (MGD)	5.00	15.00	10.00	20.00	**50.00**
Sewage actually generated/treated (MGD)	Nil	0.75	1.20	13.45	**15.40**
Underutilized treatment capacity (MGD)	5.00	14.25	8.80	6.55	**34.60**
Capital cost of STP (₹ in crore)	6.62	16.85	13.52	17.47	**54.46**

The treatment capacity of 34.60 MGD remained unutilized while the DJB continued to incur recurring expenditure on maintenance and operation of STPs at places where hardly any sewage was generated. Audit observed that:

- The plant at Ghitorni constructed in 1997 at a cost of ₹ 6.62 crore was lying idle since construction due to non availability of sewage in its commanding areas and the DJB was incurring expenditure on watch and ward of the plant.

The DJB accepted (March 2013) audit observation.

- Though the DJB reported sewage treatment of 0.75 MGD at Rohini STP commissioned in 2002, a DPCC report (March 2012) indicated that the plant was actually not in operation. The DJB spent ₹ 1.39 crore on operation and maintenance of the plant from April 2002 to March 2012.

  The DJB while accepting the fact of spending ₹ 1.39 crore on operation and maintenance stated (March 2013) that the underutilization of Rohini STP was for the reason that projected sewage was not being generated as planned and anticipated by DDA in the area. However, the plant remains underutilized.

- The capacity utilization of the plant at Narela commissioned in 2001 was only 12 *per cent.*

(c) Unplanned augmentation of STP capacity

The quantum of actual sewage treated at nine STPs was only 153 MGD against the total treatment capacity of 220 MGD due to failure of the DJB to plan synchronized development of all the activities of sewage collection. Further augmentation in STP capacity was beyond assessment/justification. The details of underutilization of STPs are given in **Table 2.4.**

Table 2.4: Details of under-utilisation of plants

Sl. No.	Name of the plant	Capacity in MGD	Year of commissioning	Actual treatment as on March 2012	Present capacity utilization
1	Yamuna Vihar	10 10	1999 2003	11.53	57.65
2	Nilothi	40	2002	15.00	37.50
3	Pappankalan	20	2000	13.45	67.25
4	Okhla	30 12 37 45 16	1937 1982 1993 1993 2001	113.07	66.51

- Two STPs of 20 MGD commissioned at Yamuna Vihar, were underutilized by 42.35 *percent*, another STP of 25 MGD is being constructed at the same place at a cost of ₹ 62.05 crore, without ensuring full utilization of existing capacity.

- One STP each commissioned at Nilothi and Pappankalan of capacity 40 MGD and 20 MGD respectively were underutilized by 62.5 and 32.75 *percent*. Two more STPs having capacity of 20 MGD each are being constructed at these places at a cost of ₹ 261.50 crore and ₹ 134.5 crore respectively.

- Five STPs having a collective capacity of 140 MGD commissioned at Okhla were underutilized by 33.49 *percent*. Audit noticed that another plant of 30 MGD commissioned at Okhla 2012, was not required at all as the sewage from Delhi Gate, Dr. Sen Nursing Home, Nigambodh, Sewage Pumping Stations No. 1, 2, 4 and Pahari Dheeraj is not coming to this STP.
- It can be fairly concluded that the Detailed Project Report prepared for augmentation of Okhla STP was deficient as projection for treatment for Okhla STP for the year 2006 was 170 MGD but it was treating only 113 MGD in 2012, when it was completed.

  The DJB stated (March 2013) that the under-utilization was due to non-availability of requisite raw sewage for treatment and further added that the issue would be addressed largely after commissioning of interceptor sewer and augmentation of water supply in the command area.

(d) Construction of STPs more than requirement

Audit observed that the DJB constructed STPs having capacity of 543.40 MGD as on November 2012. Since, the DJB could connect 54 *per cent* of the population with sewerage network there was a total requirement of the STPs having a capacity of 367.2 MGD in Delhi. Thus the STPs having a capacity of 176.2 MGD are either underutilized or lying idle.

2.1.7.3 Grading of STPs

A study on Evaluation of Operation and Maintenance of STPs (including 13 STPs of Delhi) in India was conducted by the CPCB, in the year 2007. The study graded seven plants of Delhi as 'Satisfactory[*], five as 'Poor[†] and one was graded as 'Very poor[‡].

The DJB stated (March 2013) that all of the STPs were functioning satisfactorily. The reply was not acceptable as the study of CPCB was based on overall evaluation of operation and maintenance of STPs.

2.1.7.4 Collection of sewage

On the basis of drinking water supplied to the population of Delhi, it is estimated that Delhi produces about 680 MGD of sewage. Out of this, the DJB collects only about 367 MGD of sewage for treatment. The reason for such a shortfall in collection is that only 54 *per cent* population in Delhi is covered through sewage lines which collect sewage and carry it to various STPs and 46 *per cent* of sewage generated in Delhi is flowing into River

[*] (i) Dr. Sen Nursing Home, (ii) Mehrauli, (iii) Okhla, (iv) YamunaVihar, (v) Kondli, (vi) Pappankalan and (vii) Coronation Pillar
[†] (i) Delhi Gate, (ii) Vasantkunj, (iii) Nilothi, (iv) Keshopur and (v) Rithala
[‡] (i) Nazafgarh

Yamuna untreated through storm water drains and continues to pollute Yamuna.

In order to reduce pollution in River Yamuna, a proposal for construction of interceptor sewer system was finalised by the Government of NCT of Delhi and forwarded to the Board for approval. The tendered cost for construction of interceptor sewer systems was ₹ 1395 crore. The DJB decided to award the Project Management Consultancy work to M/s Engineers India Limited (EIL) on nomination basis at the rate of four *per cent* of tendered cost ₹ 55.80 crore. EIL further agreed (June 2007) to undertake construction management of the project on 'Deposit Concept' at the rate of five *per cent* of tendered cost ₹ 69.75 crore. This interceptor sewer system was expected to cover a further 30.36 *per cent* of the population by collecting sewage from three major storm water drains (out of 18) and bringing it to STPs for treatment. Sewage from the remaining 15.64 *per cent* was to be dealt with by the DJB by augmentation of existing capacity of STPs at the mouth of Delhi Gate and Sen Nursing Home drains, rehabilitation of two major trunk sewers to intercept 13 storm water drains falling into Yamuna and also by construction of new STPs after achieving full utilisation of existing ones.

An agreement was signed between the DJB and the EIL for project consultancy services in January 2008. Audit observed that the EIL projected the completion of project by September 2010, whereas the works were awarded only in July 2011 with stipulated completion by July 2014, thus, defeating the early completion of project for which EIL was selected on nomination basis.

Further, since the interceptor sewer collects sewage from storm water drains, during monsoon months when the sewage get mixed with rain water, the STPs will not be able to treat the surplus quantity of sewage and the sewage will flow into Yamuna untreated.

The DJB stated (March 2013) that a proposal to lay sewerage system in 895 unauthorized colonies was under finalization and sewerage system would be laid in these colonies within next 6-7 years and further stated, that the project was delayed due to process of obtaining funding and clearance from the other departments. The mixing of rain water drain would be taken care of by constructing a weir up to such height so that the waste water would not mix with rain water. The reply was not acceptable as EIL took 14 months from May 2010, when all the clearances had been obtained to award the work and at present the construction of weir was not in the scope of works awarded.

2.1.7.5 Maintenance of sewage system

Removal of slime and silt from sewage has the effect of reducing sulphide generation. Therefore, periodic cleaning of sewers by mechanical or chemical means is necessary. Even partial blocking of the sewer by debris results in retardation of flow and consequent anaerobic decomposition of deposited

sludge. Periodic mechanical cleaning and flushing of sewers can reduce average sulphide generation by 50 *per cent*. A good continuing programme of mechanical cleaning is the foundation for controlling these parameters.

Out of selected four maintenance divisions, test check of records of West II division, responsible for the maintenance of sewers of Madipur, Patel Nagar, Rajinder Nagar, Inder Puri and Punjabi Bagh assembly constituencies, revealed that they did not undertake periodical cleaning of sewers. The division had been provided with three Jetting-cum-Suction machines hired by the SDW-VI division, one hired by the division itself and one departmental machine. The sewers were cleaned/ desilted as and when there was a complaint and the complaint register only showed that complaint had been attended. Audit noticed that the division did not maintain proper records like log books, complaint, registers etc. regarding utilization of these machines. In the absence of proper records, it could not be verified in audit whether the available machines were optimally utilised and the cleaning operations were completed as per schedule and the payments made to the party were authorised.

The DJB stated (March 2013) that the work of desilting were being carried out before onset of monsoons every year and average 4-5 complaints were attended to by one jetting machine. The reply was not acceptable as no evidence was furnished in support of their reply and no proper record of log book was maintained.

(a) Inadequate safety equipment

As per the DJB's Safety Code, all necessary personal safety equipment as considered adequate by the Engineer-in-charge are to be made available and maintained in a condition suitable for immediate use of the persons employed on the site and the contractor should ensure proper use of equipment by those concerned. The DJB had constituted a task force team from its Safety and Disaster Management Cell for checking the safety equipment and their utilization at its own and work sites of the contractor.

Audit noticed that the task force team inspected the sewer stores at Pitampura/ Shalimar Bagh, Rampura, Sarawati Vihar, Paschim Vihar, Sakur Pur, Beriwala Bagh, Nimri Colony, Dhandhan Satguru Sewer Store under North West-III in August 2012 and pointed out shortage of safety equipment.

The DJB while accepting the facts stated (March 2013) that the directions had been issued to ensure that all sewer stores were equipped with the required safety equipment.

2.1.7.6 Release of harmful gases into air

In STPs, sludge digesters digest the sludge in the absence of oxygen. During this process, poisonous gases like methane, hydrogen sulphide and carbon dioxide are produced which are collected in the dome of the sludge digester

and, thereafter, transferred to gas holders for further disposal. Audit scrutiny revealed (August 2012) that 37 out of 62 digesters were not working in the selected 15 STPs. Due to this, about 7.27 lakh cubic feet of harmful gases produced at Okhla, Keshopur and Rithala phase-I STPs were escaping into the atmosphere every day. Contrary to this, 3.04 crore cubic feet of gases has been burnt through burner instead of utilising it for generation of electricity at Yamuna Vihar STP during last five years, as the provision of utilizing the gas for generation of power was not made at this plant, in spite of the recommendations of the CPCB (2007).

The DJB, accepting the facts, stated (March 2013) that the supply of biogas to the subscribers in command area of SDW Okhla was disbanded on financial, technical and safety reasons and the production of gas was reduced due to non-functional sludge digesters that would be made functional within three years.

2.1.7.7 Quality of treated sewage

The STPs are required to have a reliable mechanism to measure the quantity of the effluents being discharged into the River Yamuna and ensure adherence to the stipulated quality parameters.

Scrutiny of records revealed that most of the STPs were equipped with in-house laboratories to analyse the samples of effluent collected from different units of the STPs to ensure their conformity with the standards prescribed by the DPCC under the provisions of the Water (Prevention and Control of Pollution) Act, 1974. In addition, the DPCC had conducted analysis of Total Suspended Solids (TSS), Bio-Chemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) monthly to monitor the quality of effluent being discharged from the STPs but they were deficient. Test check of the records of the STPs, DPCC and CPCB revealed deficiencies as discussed below:

As per tests conducted by the DJB, effluent from test checked STPs did not meet the prescribed standards. Though the Rithala STP Phase-II was meeting the prescribed standards (30 BOD & 50 TSS), it was not meeting the standards (15 BOD & 20 TSS) for which it was designed. Further, as per Reports of the DPCC and CPCB during April 2011 to March 2012, STPs with total treatment capacity of 51 MGD out of 206 MGD was not meeting the prescribed standards. The results from Keshopur STP were not analaysed as its rehabilitation work was under progress since May 2008.

The total coliform and faecal coliform shows the presence of faecal coliform bacteria indicating contamination with faecal material of humans or other animals. Contaminated water contains pathogens which are responsible for spread of many contagious diseases. The DJB did not analyse the standard of total coliform and faecal coliform at any of its plants test checked.

The procedure for collecting and testing samples stipulated that the samples should be composite i.e. should be taken at regular intervals during the course of a day so that the test results depict a true picture of the quality of the effluent. However, it was noticed that tests were conducted by the DJB only once a day at Okhla, Keshopur, Rithala Phase-II, Pappankalan, Yamuna Vihar and Narela STPs, while the tests were conducted at Rithala Phase-I, on alternative day and once a week at Rohini STP. Thus, the tests conducted by the DJB do not provide a credible assurance of the quality of treated sewage.

The DJB stated (March 2013) that mode of sample collection was on grab and composite basis at all STP's Labs. and the testing was conducted at Rithala phase I on alternative day due to inadequate sewage and the effluent met the DPCC standards. The reply was not acceptable as mode of sample collection was not composite at the selected STPs and test results made available to audit did not confirm the statement. The DJB further stated that rehabilitation of STPs in the command areas of Kondli STP, Rithala STP and Okhla STP had been proposed in YAP-III and the output parameters would be improved.

2.1.7.8 Other irregularities in construction and maintenance of STPs/SPSs

The DJB was responsible for construction and functioning of the infrastructure created for treatment of sewage in Delhi. To achieve the intended results of economy in construction and minimize the input cost in running the STPs and SPS, the DJB was required to take necessary steps.

(a) Cost escalation of ₹ 81.09 crore due to poor planning and disposal of untreated sewage of 42 MGD

The Detailed Project Report and the block estimates for augmentation of capacity of Okhla STP from 140 MGD to 170 MGD for ₹ 94.37 crore[§] were prepared and technically sanctioned. Planning Cell of the DJB cleared the proposal in September 2002 but the consultant was appointed in 2006 after a gap of three and half years. Tenders for the work were called by January 2007 and the work was awarded to M/S Degramont (India) Ltd. in December 2007 at a tendered cost of ₹ 149.50 crore. The work was awarded at the design parameters of BOD of 20 mg/ L and TSS of 30 mg/ L though the estimates were approved (September 2002) at BOD of 10 mg/ L and TSS of 15 mg/ L. Audit noticed that the DJB took five years to award the work after it was sanctioned. In this time, the cost had risen by ₹ 56.04 crore besides untreated sewage of 30 MGD flowed into river Yamuna during the period.

Similarly, the plant of 12 MGD capacity at Keshopur was not functioning since 1999. The plant required reconstruction for which the consultant was

[§] including cost of up gradation to achieve BOD 10 mg/Ltr and S.S. 15 mg/Ltr. (₹ 25.5 crore), cost of automation (₹ 6.90 crore), operation and maintenance for 10 years (₹ 8.25 crore), consultancy services (₹ 0.91 crore) and contingency (₹ 2.75 crore)

appointed in 2006, after a gap of eight years. The tenders for the said work were called in August 2007 and the work awarded (May 2008) at a tendered cost of Rs 51.20 crore. The award of work after a gap of eight and half years resulted in cost escalation of ₹ 25.05 crore. During the intervening period, 12 MGD of untreated sewage kept flowing into River Yamuna.

The DJB while accepting the facts stated (March 2013) that the construction of both the STPs was put on a slow track due to slow growth of sewerage network in Okhla catchment area and Keshopur STP was not receiving full sewage. The fact remains that due to inordinate delay, the DJB incurred excess expenditure of Rs. 81.09 crore on construction of these two STPs.

(b) Non-imposition of penalty of ₹ 37.14 crore for delay in completion of projects

The DJB tender conditions stipulate that the compensation for delay shall be calculated at the rate of 0.10 *per cent* (one tenth of one *per cent*) of the contract price for every day or part thereof subject to a maximum of 10 *per cent* of the contract price, which will elapse between the stipulated time of completion and the date stated in the taking over certificate.

Audit scrutiny revealed that five works **(Annexure-2.1)**, awarded between September 2005 and May 2008, were to be completed within 24 months of the award. However, only one work was completed (June 2012), that too with the delay of 30 months and remaining four works had not been completed up to December 2012, even after delay of two to four years. There was no delay on the part of the DJB as all the projects were on Design Built and Operate (DBO) basis and contractors were handed over the sites in time. It was observed that the DJB had not even issued notices for delay in progress of constructions, to the contractors. The penalty leviable for delay in completing projects worked out to ₹ 37.14 crore. Delay in completion of the works not only resulted in time and cost overrun but also in non-achievement of the objective of the projects which were part of Yamuna Action Plan (Phase-II).

The DJB stated (March 2013) that delays were on account of seasonal rain, abnormal increase in cost of material, shortage of labour due to crop summer season, Assembly and Parliamentary election and were not attributable to the firms and as such compensation was not levied. The reply was not acceptable as all the reasons stated by the DJB were of foreseen nature and could have been accounted for by the DJB before award of works.

(c) Non-recovery of water charges from CPWD, DDA and PPCL amounting to ₹ 23.81 crore

According to Rule 9 of the General Financial Rules, it is the duty of the Department of the Central Government concerned to ensure that the receipts and dues of the Government are correctly and promptly assessed, collected and duly credited to the Consolidated Fund or Public Account as the case may

be. The DJB charges ₹ 1.25 per kilolitre for supply of effluent water for horticulture purposes and ₹ 4 per kilolitre for commercial purposes.

Scrutiny of the records of STPs at Okhla and Rithala revealed that the DJB was supplying 20 MGD effluent water to the CPWD for gardening purpose from STP Okhla and one MGD to Pragati Power Corporation Limited (PPCL) for commercial purpose and 3 MGD to DDA for horticulture purposes from Rithala STP. However, neither any MOU/ agreement was signed with these agencies nor terms and conditions finalized for supply of this water. The Okhla STP supplied 138.67 lakh kilolitres of effluent water costing ₹17.27 crore to CPWD during 2007-12. Similarly, an amount of ₹ 6.54 crore was also due from DDA and PPCL for the effluent water supplied from Rithala STP. But, neither demand was raised on these agencies by the DJB nor the amount was paid by them. The DJB stated (December 2012) that 40 MGD of Yamuna water, as share of CPWD, was being utilized by it and in lieu, the DJB was supplying 20 MGD of effluent to the CPWD. The reply was not acceptable as documents in support of their reply were not furnished for verification.

The DJB reiterated its earlier contention, and stated (March 2013) that no MOU was available with the DJB or CPWD. It was further stated that the agreement for supply of treated effluent water had been signed between the DJB and PPCL. The fact remains that the amount is still outstanding against these agencies and the reply regarding the release of 20 MGD treated water to CPWD in lieu of 40 MGD was not acceptable as the Member (Finance) of the DJB requested (December 2010) the CPWD to pay the cost of 20 MGD effluent water and maintenance charges of EPH.

(d) Irregular payment of ₹ 17.85 crore on account of Service Tax and VAT

According to Clauses 37 and 38 (1) of the General Conditions of Contract (GCC), all tendered rates shall be inclusive of all taxes and levies (except service tax) payable under respective statutes. In respect of service tax, the same shall be paid by the contractor to the department concerned on demand and it will be reimbursed to him by the Engineer-in-Charge after satisfying that it has been actually and genuinely paid by the contractor. Scrutiny of the records revealed that the DJB did not include the above clauses of general conditions of contract in the agreement.

The DJB paid service tax to the tune of ₹ 4.12 crore to various contractors during the period 2007-12 through running bills. Payment of service tax without ensuring that the same has actually been paid by the contractor to the department concerned was irregular.

Another condition for payment of VAT was accepted by the DJB while awarding the works. Audit is of the view that the VAT was also to be reimbursed to the contractors in the manner in which service tax is to be

reimbursed as the contractors collected this amount, as custodian of government money. The DJB paid VAT to contractors to the tune of ₹ 13.73 crore during 2007-12.

Thus, non-inclusion of relevant clauses of GCC in the contract agreements, resulted in absence of a mechanism for verification of payment of service tax and VAT amounting to ₹ 17.85 crore by the contractors to the department.

The DJB stated (March 2013) that there were no instructions earlier that the service tax would be reimbursed only after deposit. As per VAT provisions the DJB had to deduct the TDS-VAT from the bills of contractor. The reply was not acceptable as clause 37 and 38 of the GCC clearly state that service tax would be reimbursed and the contractor's payment would include all taxes and levies. Despite this, the DJB accepted the condition of payment of VAT and did not ensure its deposit into Government account by the contractors.

(e) Cost escalation of ₹ 11.65 crore due to abnormal delay in award of works by the DJB

As per provisions of the CPWD Manual, the DJB was required to award the works within 90 days of the receipt of the tenders. It was noticed that the construction work of 30 MGD STP at Okhla was awarded by the DJB after one year from the receipt of the tenders. As the contractor was eligible for escalation under the clauses of the tender, the DJB incurred an extra expenditure of ₹ 2.90 crore due to the increase in cost of the project.

Similarly, the tenders for the work of Demolition, Design, Construction, Commissioning and O & M for 10 years at Keshopur STP were called in August 2007 but the work was awarded in May 2008 with the delay of eight months resulting in cost escalation of ₹ 8.75 crore. Thus, abnormal delay in award of works led to the cost overrun by ₹ 11.65 crore apart from delay in execution of the project.

The DJB stated (March 2013) that the works were to be awarded after obtaining NOC from the Japan Bank for International Cooperation (JBIC) and thus the delay occurred. The reply was not acceptable as CPWD Manual prescribed the time limit after considering all such factors and the delay of one year from receipt of tenders to award of the work was abnormal.

(f) Infructuous expenditure of ₹ 10.20 crore on biological treatment

Scrutiny of the records revealed that the DJB proposed 'Biological Treatment of sewage waste water' at suitable points in the collection system/various STPs for elimination of odour and reduction in BOD and TSS of secondary effluent. It was observed that no tests were conducted before award of work to assess whether the proposed treatment is necessary and would be effective. The works of biological treatment was awarded to contractors at a cost of ₹ 10.20 core during April 2007 to April 2010. It was noticed from the records that the treatment was not continuous but intermittent. Biological treatment at

30 MGD plant was done from 2 June 2009 to 8 November 2009 and 31 January 2010 to 20 May 2010 and at 45 MGD plant at Okhla, the treatment was done from 9 September 2009 to 6 January 2010. At Rithala phase-I and Okhla STPs, it was noticed that there was no improvement in the BOD level. The Apex Advisory Committee constituted to study the utility of biological treatment and the Tata Energy and Resources Institute (TERI) appointed as a nodal agency to evaluate the trial Bio-formulations, found that biological treatment was not required as the parameters of the treated effluent at Okhla and other plants were meeting the DPCC norms. Subsequently, the DJB decided that use of such enzymes/bio-formulations in any kind or in any form would not be done at any STP.

Thus, biological treatment of sewage without carrying out any preliminary study to assess its utility or requirement resulted in infructuous expenditure of ₹ 10.20 crore **(Annexure-2.2)**.

The DJB, accepting the facts, stated (March 2013) that the work at Okhla STP was undertaken on pilot basis and there was a reduction of odour and improvement of BOD and COD levels and it had now been stopped after a policy decision. The fact remains that the enzyme was used not only at Okhla STP but at other STPs also and there was no improvement in the BOD and COD levels as per Lab. reports made available to audit.

(g) Loss of ₹ 6.39 crore due to underutilization of STP Okhla

Five STPs with total capacity of 140 MGD were in operation at Okhla which were underutilized by 20 MGD. However, without ensuring optimum utilization of the plant, a new STP of 30 MGD capacity was constructed at a cost of ₹ 149.50 crore including operation and maintenance for 10 years which was commissioned in June 2012. Out of the 120 MGD of sewage generated in catchment area of these STPs, 110 MGD is being treated by the old plants and 10 MGD by new plant. The new plant is under O&M contract for 10 years at a rate of ₹ 2.56 crore per annum. Further, the plant was to be run on the power generated from its by-product i.e. bio-gas from the plant. Thus, due to underutilization of the plant, the DJB suffered a loss of ₹ 6.39 crore on account of cost of O&M and power generation up to November 2012. Further, there is a recurring loss of ₹ 49.13 lakh per month besides two STPs of 10 MGD each are deteriorating with passage of time due to their idleness.

The DJB accepted the facts and stated (March 2013) that efforts would be made to utilize the plant.

(h) Loss of ₹ 6.25 crore on release of interest free mobilization advance

According to Section 32.5 of the CPWD Manual, in respect of certain specialised and capital intensive works costing not less than two crore, mobilization advance limited to a maximum of 10 *per cent* of the estimated cost put to tender or tendered value, at 10 *per cent* simple interest shall be

sanctioned to the contractors on specific request as per terms of the agreement. The CVC had also directed (1997) that in no case interest free mobilization advance to the contractors be given.

Audit noticed that against the provisions of the CPWD Manual and CVC instructions, the DJB released ₹ 50.37 crore as mobilization advance to contractors in six projects as detailed in **Table 2.5.**

Table 2.5: Detail of interest on mobilization advance

(₹ in crore)

Sl. No.	Name of work	Project cost/Contract amount	Amount of mobilization advance	Interest on mob. advance
	Civil work			
1	Constn. of 50 MGD S.P.S. & related associated/allied appurtenant works on Design, Build & Operate basis at Yamuna Vihar, Shahdra, Delhi.	15.84	0.95	0.14
2	Constn. of 25 MGD S.T.P. & related associated/allied appurtenant works on Design, Build & Operate basis at Yamuna Vihar, Shahdra., Delhi	44.83	1.51	0.40
3	Design, Construction, Commissioning & Operation & Maintenance of 136.4 MLD (30 MGD) capacity STP at Okhla, under YAP-II	123.87	6.02	0.45
4	Demolition, Design, Construction, Commissioning & Operation & Maintenance of 12 MGD capacity STP & Rehabilitation of 02 existing modules of 20 MGD & 40 MGD capacity STP at Keshopur, under YAP-II	139.34	7.94	0.52
5	Rehabilitation of Ring Road Trunk Sewer-Slice "A" from Red Fort to Pragati Maidan (Exhibition Ground), under YAP-II	43.79	4.37	0.48
6	Rehabilitation of Ring Road Trunk Sewer-Slice "B" from Pragati Maidan (Exhibition Ground) to Ring Road SPS under YAP-II	63.80	6.38	1.22
7	Providing consultancy services for JBIC aided, YAP-II Projects-Physical implementation of works in Delhi	17.51	1.56	0.18
	Electrical & Mechanical (E&M) Work			
8	Constn. of 50 MGD S.P.S. & related associated/allied appurtenant works on Design, Build & Operate basis at Yamuna Vihar, Shd., Delhi.	15.84	6.38	0.12
9	Constn. of 25 MGD S.T.P. & related associated/allied appurtenant works on Design, Build & Operate basis at Yamuna Vihar, Shd., Delhi.	44.83	2.98	0.89
10	Design, Construction, commissioning & operation & maintenance of 136.4 MLD (30 MGD) capacity STP at Okhla under YAP-II	123.87	5.80	1.24
11	Demolition, Design, Construction, commissioning & operation & maintenance of 12 MGD capacity STP & Rehabilitation of 02 existing modules of 20 MGD & 40 MGD capacity STP at Keshopur under YAP-II	139.34	8.05	0.60
	Total		**51.93**	**6.25**

The works of E&M were to be started after one year of the release of advance. Audit also noticed that in one case the interest free mobilization advance of ₹ 1.56 crore was paid to the consultant in contravention of the provisions of the Manual leading to loss of interest ₹ 0.19 crore. Though as per agreement, the advance was to be recovered from the contractors within 12 months from the date of payment but it was recovered up to 48 months after the date of advance.

The undue benefit granted to the contractors by way of irregular mobilization advances resulted in loss of ₹ 6.25 crore to the DJB.

The DJB stated (March 2013) that the FIDIC conditions were adopted in two works and in five works, it was mandatory for the DJB to follow the conditions of JBIC's standard documents, which allow the DJB to grant the interest free mobilization advance to the contractors. The reply was not acceptable as there was no documentary evidence to follow the conditions of JBIC standard bidding documents. Moreover, the CVC guidelines issued in 1997 provide that in no case the interest free mobilization advance be given to the contractors.

(i) Non-recovery of ₹ 2.69 crore on account of repair and maintenance charges of Effluent Pump House (EPH) from CPWD

As per policy of the DJB, the effluent water would be supplied by the DJB from STPs and carrying the effluent water would be the responsibility of the buyer. Audit scrutiny of the records of STP Okhla revealed that an EPH at Okhla plant was supplying 20 MGD water to CPWD for horticulture purposes. The electricity and operation of EPH was to be reimbursed by CPWD against the demand raised by the DJB. Scrutiny revealed that the DJB incurred an expenditure of ₹ 2.69 crore on repairs and maintenance of the EPH during 2009-2011 which was to be borne by CPWD. The demand of ₹ 2.69 crore was not raised by the DJB on the CPWD. The Executive Engineer (Division) stated that the cost of repair and maintenance of EPH was being met from DJB's budget and as per agreement, the CPWD was required to pay the electricity and operational charges which was being recovered. In support of their reply, the DJB did not furnish the document.

The DJB further stated (March 2013) that the repair and maintenance charges against the EPH Okhla were not reimbursable by CPWD on the basis of mutual agreement. However, the DJB admitted that no copy of MOU was available with it. The fact remains that the DJB was required to claim the repair and maintenance charges from CPWD in terms of letter of the DJB of July 2004 and Member (Finance) letter of December 2010.

(j) Inadmissible payment of ₹ 1.39 crore on account of VAT

The work of providing 30 vehicle mounted jetting-cum suction sewer cleaning machines (**Annexure-2.3**) including its operation and maintenance was

awarded to M/S City Line Travels Pvt. Ltd. in April 2006 for a period of five years at a cost or ₹ 5.76 crore (at the rate of ₹ 3200 per day per machine). As per terms and conditions of the agreement, the rates included all taxes as applicable to government/semi-government department till the deployment of machines in Delhi, except government levies/taxes on hiring of these machines which were to be paid extra.

According to the VAT Act, VAT on renting of machinery is applicable in case of transfer of right to use. However, in this case, the contractor had provided the services of machine along with its operation and maintenance and therefore, there was no 'transfer of right to use'. Audit observed that while preferring bills, the contractor claimed VAT @ 12.5 *per cent* along with his claims. Machinery/equipment transferred along with the operator should be treated as transfer of goods without transferring right of possession and effective control and hence, levy of VAT was not applicable. However, the DJB paid ₹ 1.39 crore to the contractors during 2007-12 on hiring of jetting cum suction sewer cleaning machines, which was inadmissible and thus, recoverable from the contractors.

The DJB stated (March 2013) that the VAT was paid considering the transfer of right to use and the overall control of the machine remained with it. The reply was not acceptable as in this case the DJB could use the machine only for eight hours in a day and six days in a week. The right to use was applicable only if DJB had acquired the machine for full period of agreement.

(k) Unfruitful expenditure of ₹ 0.17 crore on improvement of power factors at pumping station

According to para 13.3.8 (b) and (c) of General Specifications for electrical works, the Power Factor (PF) should be maintained above 0.8 level or any higher value fixed by the licensee. As per BSES norms, the power factor should be 0.98 in Delhi. Scrutiny of the records revealed that the power factor at Kilokari Pumping Station was 0.86 to 0.94 during April 2008 to May 2010 and at Ring Road Pumping Station, 0.74 to 0.89 during April 2008 to March 2010. To improve the power factor at both the pumping stations, the work of 'Improvement of power factor at Ring Road Pumping Station' and 'Improvement of power factor at Kilokari Pumping Station' were awarded to M/S Rajdhani Enterprises in February 2010 and June 2010 at a cost of ₹ 8.63 lakh and ₹ 7.93 lakh respectively. The works were completed in March 2010 and July 2010 respectively and payments were released to the contractor by the DJB in March 2010 and October 2010. The guarantee period of both the works was one year. However, scrutiny of the records revealed that the power factor at Ring Road pumping station remained at 0.84 to 0.96 after the improvement work and never touched the required level of 0.98 and it reduced to 0.79 in January 2011 and 0.77 in May 2011, below the required level. Similarly, the power factor at Kilokari pumping station remained 0.89 to 0.94 during August 2010 to September 2011 and never touched the required level

of 0.98. It was also noticed that the power factor at Kilokari pumping station remained more or less the same, before and after the improvement work. Thus, the expenditure of ₹ 16.56 lakh did not fulfill the intended purpose and hence was unfruitful.

The DJB stated (March 2013) that the performance of the new capacitors was not upto the mark as these were installed along with the old/damaged capacitors. The reply was not acceptable as contractor was required to maintain the power factor of 0.98 or more during the guarantee period as per the agreement.

2.1.7.9 Monitoring and evaluation

The existence of an effective monitoring system is a pre-requisite for smooth functioning of a scheme. As per guidelines of the Ministry of Environment and Forest, the DJB was required to constitute a Project Monitoring Committee and the Ministry was also required to visit the STPs and Projects to review the progress and monitoring of the STPs. It was noticed that though the Project Monitoring Committee was constituted by the DJB, it was not effective. As a result, planning and budgeting was not meticulously coordinated for the implementation of the programmes/ schemes of sewage treatment. This affected efficient implementation of the sewage treatment in Delhi. Though the STPs were in operation since long, no evaluation study of the STPs was undertaken during 2007-12 to assess the impact of the STPs/ SPS and Sewage Network. No return was being sent by the STPs/ SPSs/ Divisions to the higher authorities except a daily test report of effluent and monthly progress report (physical and financial) of the projects. The CPCB, Ministry of Environment and Forests, while evaluating the operation and maintenance of STPs in India observed (2007) that there was no mechanism for physical monitoring of the performance of STPs constructed and commissioned under National River Conservation Project (NRCP) by the Ministry of Environment and Forests. CPCB in its report of January 2008 had also stated that these were seldom visited by higher officers of National River Conservation Directorate (NRCD) in the Ministry so as to get first-hand information on the status of O&M of STPs by the State Governments/implementing agencies. Moreover, the scope of work of Project Management Consultants (PMC), appointed by the Ministry for implementation of YAP - II, includes monitoring of O&M of all the STPs constructed in Delhi, UP and Haryana under YAP – I. But it is understood that no action has been taken by NRCD in this respect since the appointment of PMC two years back. Regular monitoring of all the STPs for their performance evaluation at central level (CPCB) twice a year, by having own independent sampling/testing of waste water needs to be carried out for bringing improvement in O&M of STPs and get the desired quality of treated effluent.

A few instances of failure of DJB's monitoring are as under:

- A 40 MGD STP was constructed at Rithala phase-I in 1989 and is being operated by the DJB. Another plant at Rithala phase-II of 40 MGD capacity at a cost of ₹ 81.93 crore (including O & M of the plant) was constructed by M/S Degramont (India) Ltd, in 2002. As per terms and conditions of the agreement the firm was required to operate the plant along with minor repairs and lubricants. The costs of replacement of the equipment were to be borne by the DJB for which the firm was to charge 10 *per cent* extra for handling etc. Against the expected life of 30 years of the plant, the plant required rehabilitation within 10 years incurring an expenditure of ₹ 12.74 crore for replacement of equipments whereas the plant at Phase-I was functioning properly since 1989. The reason stated for rehabilitation was failure on the part of the DJB to provide timely budget for replacement of equipment. Thus, the failure of the DJB to monitor the functioning of the plant resulted in avoidable expenditure of ₹ 12.74 crore.
- The bio-gas produced at Okhla STP was being supplied to nearby residents through pipeline at the rate of ₹ 125 per month. However, due to failure of the DJB in monitoring the maintenance of the pipeline and repair of digesters in time, the supply was stopped in January 2010, resulting in escape of harmful gases into the atmosphere.

The DJB, accepting the facts, stated (March 2013) that the Project Monitoring Committee would be constituted for effective monitoring.

2.1.8 Audit findings in DSIIDC for construction of CETPs

2.1.8.1 Industrial sewage

The C&AG of India had earlier reviewed the functioning of Industrial Sewage System of Delhi in its Report for the year ended March 2004 (Vol. II) on 'Measures to Control Water Pollution in River Yamuna' in Delhi. The report highlighted mismanagement in construction as well as operationlisation of Common Effluent Treatment Plants (CETPs). The action taken notes (ATNs) on audit comments on industrial sewage system had not been furnished by the Department of Industries which is the administrative department of the DSIIDC[**].

Audit further examined the records relating to the construction of CETPs by DSIIDC and subsequent operationlisation of plants by various CETPs Societies. The role and responsibility of DSIIDC in this regard was examined and audit findings are detailed in the succeeding paragraphs.

[**]Delhi State Industrial Infrastructure Development Corporation

(a) Plants not constructed

As per Delhi Master Plan 2001, there were 28 approved industrial estates in Delhi. In the year 1996, the Hon'ble Supreme Court directed the Government of NCT of Delhi to study and recommend ways and means to handle water pollution in Delhi. The Government of NCT of Delhi appointed (March 1996) NEERI as consultant through Delhi Pollution Control Committee (DPCC) to prepare detailed project reports including design and specification of CETPs. As per the decision taken by the Delhi Administration, DSIIDC was to undertake construction of CETPs as per technical know-how provided by NEERI.

NEERI, after survey of all the industrial areas in Delhi, recommended (June 1996) construction of 15 CETPs in 21 Industrial Estates with a total treatment capacity of 191.4 Million Litre per day (MLD), i.e.42 MGD. The remaining seven Industrial Estates had either non-polluting industries or their own treatment arrangements. All the CETPs were to be completed by 1998.

Out of these, DSIIDC had constructed and made functional 11 CETPs prior to 2005 with a total capacity of 34.05 MGD at various industrial areas in Delhi. The construction of remaining four CETPs at (i) Mohan Co-operative, Badarpur, (ii) Najafgarh Road, (iii) Anand Parbat and (iv) Okhla Industrial Estates were pending as the matter was under review by DPCC as to whether the CETPs were required or not. The report of DPCC was awaited as of March 2013. Apart from these, DSIIDC had also constructed two more CETPs at Narela and Bawana under Narela scheme and Relocation scheme respectively.

Even after a lapse of 14 years after the stipulated completion time, the whole project to treat the industrial waste water could not be completed. The industrial areas where these four CETPs were proposed had several industries and waste water generated was reaching drains flowing into the river Yamuna. Thus, the purpose of controlling pollution of river Yamuna could not be achieved in full. Further, it was also noticed that DSIIDC had incurred a sum of ₹ 8.88 crore as capital expenditure on the incomplete four CETPs. Thus, there was an unfruitful expenditure to that extent by the Delhi Government **(Annexure-2.4)**.

(b) Delay in handing over of CETPs to Societies

In terms of provision of the Delhi Common Effluent Treatment Plants Act, 2000, CETP Societies were to be formed, which were to be entrusted with the maintenance and operation of the plants after completion. All the CETPs were to be constructed by 1998 and handed over to CETP Societies. However, there

were inordinate delays in completion and handing over of CETPs as detailed in **Table 2.6.**

Table 2.6: Delay in handing over of CETPs

Name of CETP	Year of completion	Date of handing Over
Wazirpur	2001	31.3.2006
Mangolpuri	2001	25.10.2005
Mayapuri	2002	27.10.2005
Jhilmil	2003	2.1.2006
GTK Road	2004	20.10.2005
SMA	2004	17.2.2207
Nangloi	2004	21.10.2005
Badli	2005	16.3.2006
Okhla Industrial Area	2005	1.3.2006
Naraina	2010	1.6.2011
Narela*	2004	15.3.2012
Bawana*	2011	16.4.2012
Lawrence Road	2004	Run by DSIIDC

** Not covered under the Supreme Court orders*

The delay in completion of CETPs ranged between three and 12 years. There were also delays in handing over of these CETPs to various societies for operationlisation ranging between one and eight years. On this being pointed out, the DSIIDC stated (March 2013) that CETP societies were reluctant to take over the Plants initially and it was only after the intervention of the Hon'ble Supreme Court and EPCA, they took over the CETPs.

Audit observed that inordinate delays in completion of the plants eventually delayed treatment of waste water from the industrial estates, allowing it to flow untreated into river Yamuna.

The CETP at Lawrence Road was completed in 2004 but could not be handed over to the CETP society as the Plant was not meeting the desired parameter of BOD. The Plant was designed for treating sewage with only 89 ppm of BOD while the incoming BOD was in the range of more than 200 ppm and as such it could not be treated in the Plant. The matter has not been checked by NEERI, DPCC and DSIIDC so far. The DSIIDC had incurred an amount of ₹ 6.75 crore as of October 2012 in running of this Plant. Had the matter been resolved with the CETP society and the plant been handed over to the society, the expenditure on running of this plant at its own, could have been avoided by the DSIIDC.

The DSIIDC stated (March 2013) that CETP at Lawrence Road, could not be handed over to CETP Society as the Society refused to take over the plant on the plea that it did not have Biological treatment unit to treat the excess BOD. It further added that efforts were being made to improve BOD parameter. Presently, analysis by DPCC indicated that the plant was meeting out the BOD parameters now and efforts were being made to hand over it to the CETP Society, Lawrence Road for its operation and maintenance.

The fact remains that the plant was designed with lower parameters for treating excess BOD.

(c) Industrial areas not covered by CETPs

A CETP in an area is constructed to treat the waste water of all the industrial units in that area. However, as per information provided (October 2012) by the Jhilmil and Friends Colony Industrial area CETP Society, 54 industrial units were not connected to their CETP. Further, as per status report of EPCA on functioning of the CETPs, the industrial drain in Okhla Industrial was not connected to Okhla CETP. This indicated that the industrial waste water from these areas was flowing untreated through drains into river Yamuna.

Thus, there was a need to re-examine the whole project by the Delhi Government to ascertain the position regarding coverage of all the industrial units of Delhi to achieve the purpose of treating water waste being discharged into the nearby drains which finally reaches river Yamuna.

On this being pointed out, DSIIDC stated (March 2013) that 54 industrial units were situated in a non-approved industrial area, hence, were not connected to CETP, Jhilmil. The reply was factually incorrect as Audit noticed that these industrial units were in the list of members of CETP Societies, Jhilmil and Friends Colony Industrial area. It was further stated that all the industries situated in Okhla industrial area were connected to CETP and if any industrial unit was discharging its effluent in Okhla drain, DPCC was the competent authority for taking suitable action on defaulting industries. The reply does not address the issue that the industrial drain in Okhla Industrial area was not connected to Okhla CETP.

(d) Capacity of the plants

As per the recommendation of NEERI, the DSIIDC constructed 13 CETPs of capacities totaling to 211.80 MLD. As per the status report of DPCC, all these plants were collectively treating only 55.48 MLD of waste and none of the plants was working at its full capacity. The usage of plants ranged between five *per cent* and 62.50 *per cent* of their installed capacity. This is indicative of the fact that the capacity of the plants was much higher than requirement reflecting faulty assessment of the production of industrial waste. Thus, CETPs and the amount invested thereon were being underutilized due to defective planning.

The DSIIDC stated (March 2013) that CETPs were constructed as per the design and capacity provided by NEERI. CETPs were treating all the industrial waste being received through the conveyance system. The reply further confirms that defective planning and poor conceptualization of the project led to underutilization of plants of their installed capacity.

(e) Management of sludge from CETPs

As per the survey conducted by the DPCC in 2007, 5769 MT of sludge generated was stored in the premises of various CETPs. Survey also indicated that CETPs were generating 1400 MT sludge per annum. Accordingly, total sludge lying in CETP premises was 12769 MT as of November 2012.

The EPCA in its survey reports of November 2011 directed the Delhi Government to decide the matter regarding disposal of hazardous waste on priority. The EPCA had also asked CPCB and DPCC to explore the possibility of utilisation of suitable hazardous wastes in cement kilns. Despite clear directions of EPCA, the Sludge had been lying in the premises of CETPs posing a threat to the environment and health of the masses.

The DSIIDC stated (March 2013) that DPCC/ Department of Environment, Government of NCT of Delhi was making efforts for identifying a suitable site for proper disposal of sludge.

(f) Non-recovery of CETP costs

In accordance with the directions of the Hon'ble Supreme Court and the Delhi CETPs Societies Act, 2000, the project cost of CETPs was to be apportioned between the Government of India, Government of NCT of Delhi and CETPs Societies in the ratio of 25:25:50 respectively. The recurring cost of CETPs shall be completely borne by the occupiers in the estate. The DSIIDC was to collect the share of the project cost from the Government of India, Government of NCT of Delhi and CETP Societies in the proportionate share.

As of October 2012, an amount of ₹ 222.53 crore has been incurred by the DSIIDC on the construction and running of these 15 CETPs. Audit noted that against the share of ₹ 85.35 crore receivable from the Government of Delhi, the DSIIDC received an amount of ₹ 124.97 crore. Thus, DSIIDC has received an excess amount of ₹ 39.62 crore from the Government of Delhi. Whereas, there was an outstanding amount of ₹ 78.71 crore (₹ 15.02 crore from Government of India and ₹ 63.69 crore from CETP Societies) which needs to be recovered by DSIIDC **(Annexure-2.4).**

The DSIIDC stated (March 2013) that EPCA was directed by the Hon'ble Supreme Court in February 2006 to examine the issue of liability of the cost to be borne by industries and the Government of India but the directions of Supreme Court based on EPCA report was still awaited.

Conclusion

The sewage management in Delhi was found to be deficient in various aspects. It was observed that the DJB was able to collect and treat only 54 *per cent* of the total sewage generated in Delhi whereas remaining 313 MGD of sewage was flowing untreated into river Yamuna through storm water drains. A proposal for construction of interceptor sewage system for trapping 207 MGD of sewage from storm water drains and carrying the same to STPs was finalized in June 2007 but the works were awarded only in July 2011 with date of completion in July 2014. Action to collect and treat the remaining sewage is yet to be initiated. The DJB's failure in collecting and conveying all the sewage generated in Delhi to STPs for treatment also resulted in under utilization of available capacity of existing STPs. The treatment of sewage at seven STPs was not conforming to the prescribed standards. It was also found that the quality checks of treated sewage, carried out by the DJB, do not provide credible assurance. The financial management was not up to the mark as there were instances of cost escalation due to delay in finalization of projects, unfruitful and irregular expenditure, non-imposition of penalty on defaulting contractors and inadmissible payment of taxes.

There were critical gaps in the project for treatment of industrial waste as even after a lapse of 14 years, four out of 15 CETPs were still incomplete. CETPs were constructed with excess capacities than actual requirement and as a result, capacity utilisation ranged from 5 to 62.50 *per cent* only. Further, the whole of industrial area of Delhi has not been connected to CETPs. The sludge generated by CETPs was lying undisposed in its premises creating a health hazard to local population.

Recommendations

- *The DJB may strengthen its initiatives to achieve the GOI bench mark of 100 per cent sewage collection and treatment in a time bound manner.*
- *It may ensure simultaneous execution and completion of all related infrastructure so as to avoid mismatch between collection of sewage and treatment capacities of STPs.*
- *Proposals for creation of treatment capacity must be based on and prioritized with reference to the estimated sewage generation in the relevant catchment areas and availability of facilities to bring the same to STPs.*
- *A policy for disposal of sludge from CETPs, may be devised and timeline fixed for its implementation.*
- *The instructions issued by the EPCA should be complied with and oversight mechanism may be ensured to implement the decisions of EPCA.*
- *Steps need to be initiated to recover the outstanding share of cost of CETPs from the stakeholders.*

3.1 Thematic Audit of Water Management in Delhi

Executive Summary

A thematic audit of the Delhi Jal Board was conducted with a view to ascertaining the deficiencies in supply of potable water to the population of Delhi. The raw water available in Delhi at present is not sufficient to provide potable water to the whole population of Delhi as per prescribed norms. Two dams were proposed on river Yamuna in 1994 to augment raw water in Delhi, but were not constructed even after a lapse of 18 years after incurring an expenditure of ₹ 214 crore. The production of potable water at WTPs and waste water recycling plants was also found to be below designed capacity. The 8-MGD recycling plant at Chandrawal was commissioned after a delay of more than four years. Due to the absence of proper measurement system, whether the wastage of water during treatment process was within permissible limits at Chandrawal could not be ascertained.

The allocation of jurisdictional areas among divisions was based on Assembly Constituencies and not command areas of different treatment plants, due to which, proper measurement of water supplied to each division was not possible and accountability for loss of water could not be fixed. The drinking water was not being distributed equitably amongst the population due to lack of reliable data on population and water supplied to different areas. Further, 24.8 *per cent* of the households in Delhi were being supplied water through tankers in the absence of pipe lines.The average per capita supply was 3.82 litres per day against a prescribed norm of 172 litres. Metering of water at consumer end was not comprehensive due to which, less than 40 *per cent* of water produced was billed during last three years.

3.1.1 Introduction

The Delhi Jal Board (DJB), constituted under the Delhi Water Board Act, 1998, is responsible for the supply and distribution of potable water in the area under the jurisdiction of the Municipal Corporation of Delhi. The DJB also supplies water in bulk to New Delhi Municipal Council and Delhi Cantonment Board. The sources of water for producing potable water are YamunaRiver, Ganga water from Uttar Pradesh, water from Bhakra through Haryana, Ranney wells and tube wells.

The DJB has nine water treatment plants (WTPs). Six plants are functional with a combined capacity of production of 690 million gallons daily (MGD) of potable water. Apart from this, there are four process waste water recycling plants (total capacity 45 MGD) which produces potable water from waste water of WTP.

3.1.1.1 Organizational set up

The DJB functions under the Chairmanship of the Chief Minister of Delhi and is assisted by a Vice Chairperson, nominated by the Speaker of the Legislature and 16 other members consisting of 10 political/ex-officio members and six administrative/executive members. Member (Water) heads the Engineering Wing for water activities which is under the overall control of Chief Executive Officer (CEO), who is assisted by Chief Engineers, Superintending Engineers and Executive Engineers.

3.1.2 Audit scope and methodology

The thematic audit was conducted from June to November 2012, covering the period from April 2009 to September 2012. Records at DJB Headquarters, WTPs, Booster Pumping Stations, Process Waste Water Recycling Plants, Civil and Electrical and Mechanical (E&M)Divisions, Treatment and Quality Control Wing at Wazirabad and Revenue Wing at the DJB headquarters were examined in audit.An entry conference was held in July 2012 with the DJB to discuss the objectives and scope of audit.

All the 22 civil divisions and nine E&M divisions of the DJB were covered for collection of data. Two out of the six operational WTPs (Chandrawal and Wazirabad) and three ProcessWaste Water Recycling Plants were test checked (Chandrawal, Haiderpur and Wazirabad). A detailed study of the water trails emanating from two WTPs, viz. Chandrawal and Nangloi, their related reservoirs, command areas and distribution lines was conducted.

With a view to assessing public perception about water shortage situation,a questionnaire was sent to randomly selected 584 RWAs out of 1947 registered under the Bhagidari scheme of the Government of NCT of Delhi (GNCTD). Responses were received from 111 RWAs.

An exit conference was held on 06 March 2013 to discuss the audit findings and draw the views of the DJB on the same.

3.1.2.1 Audit objective

The objective of thematic audit was to ascertain whether:

- the raw water available in Delhi was sufficient to provide adequate drinking water to whole of the population in Delhi,
- available raw water was being processed in WTPs in an efficient manner with minimum wastage,
- quality of drinking water produced and supplied conformed to the prescribed standards,
- the system for distribution of water was designed for efficient utilisation of available water and to ensure supply of water to whole of the population as per prescribed norms,
- the system of billing and collection was efficient, and
- complaint redressal system was effective.

Audit findings

Augmentation of raw water availability

As per provisional figures of Census 2011, the population of Delhi in 2011 was 167.53 lakh, growing at the rate of 1.92*per cent* per annum. Accordingly, the projected population of Delhi in 2012 is 170.75 lakh and it would be 202.64 lakh in 2021. Considering per capita requirement of 60 gallons per day, current requirement of potable water in Delhi works out to 1025 MGD and for 2021,it would be 1216 MGD. Against this, the current production is only about 818 MGD due to shortage of raw water, leaving a gap of 207 MGD.

In terms of a Memorandum of Understanding (MoU) signed in May 1994 by five basin States, namely Delhi, Haryana, Uttar Pradesh, Rajasthan and Himachal Pradesh, the tentative allocation of Yamuna surface water to Delhi was 0.724 Billion Cubic Metres (BCM) per year. The seasonal allocation of this water is given in **Table 3.1.**

Table 3.1: Allocation of Yamuna water to Delhi

Sl. No.	Period	Allocation (in BCM)
1	July to October (monsoon season)	0.580
2	November to February	0.068
3	March to June	0.076
Total		**0.724**

As can be seen from the above, 80 *per cent* of the allocation is during monsoon season,when most of the water flows through Delhi untapped. The allocation during the remaining two seasons works out to approximately

20 *per cent*. In order to utilise flow of the river during monsoon, MoU was signed (November 1994) by the basin States to build two dams up the river at Renuka (275 MGD) in Himachal Pradesh and Kishau (372 MGD) in Uttar Pradesh (now in Uttarakhand).The GNCTD had released (October 2008) an amount of ₹ 214 crore to the Government of Himachal Pradesh for construction of Renuka dam for exclusive use of Delhi. However, work on these dams had not started even after a lapse of more than 18 years due to disagreement between the beneficiary States regarding sharing of waters and hydro power. Construction of Renuka dam is pending for forest clearance from the Ministry of Environment and Forest, GoI as the clearance earlier accorded was challenged in the Green Tribunal. Kishau dam in Uttarakhand was yet to be taken up.

The raw water for Haiderpur plant is released by the Government of Haryana at Munak (in Haryana) into Delhi branch channel and it flows to Haiderpur plant. In order to reduce loss of water during transit, Haryana proposed (February 1990) construction of an exclusive parallel Water Carrier System (WCS). The WCS was to be utilised for carrying raw water to Wazirabad Water Treatment Plant also. Accordingly, an MoU was signed (February 1993) between Haryana and Delhi for construction of this WCS at an estimated cost of ₹ 314 crore. Haryana was to maintain and operate this WCS for which annual charges were to be paid by Delhi. Once operational, a saving of 80 MGD of water was expected which would have been sufficient to run three WTPs, one each at Dwarka, Bawana and Okhla. The construction was almost complete in June 2012 and by that time Delhi government had released ₹414 crore. Later, a dispute arose between Delhi and Haryana regarding ownership of the expected savings of 80 MGD of raw water. Delhi Government approached (June 2012) Central Government for resolution of the matter. However, the expenditure of ₹ 414 crore on construction of the WCS, remained unfruitful as Delhi did not receive the additional quantity of raw water of 80 MGD.

It was observed that any significant step towards augmentation of the availability of raw water would take about 6-7 years to realize and by that time the population of Delhi would have increased and so would the demand for water.

3.1.3 Production of potable water

3.1.3.1 Water treatment plants

The DJB has six operational WTPs with acombined capacity of 690 MGD of

potable water. Details are given in **Table 3.2.**

Table 3.2: Operational WTPs

Sl.No.	Name of plant	Capacity (MGD)
1.	Chandrawal I&II	90
2.	Wazirabad I,II,III	120
3.	Haiderpur I&II	200
4.	Nangloi	40
5.	Bhagirathi	100
6.	Sonia Vihar	140
Total		**690**

Audit examined records of two WTPs (Chandrawal and Wazirabad) in detail and audit findings are discussed in succeeding paragraphs.

(a) Absence of measurement of wastage at Chandrawal WTP

Raw water for Chandrawal WTP is drawn from Yamuna at Wazirabad. Prior to construction of a twin pipeline from Wazirabad to Chandrawal in April 2012, raw water was supplied through open channels and there was no reliable data on receipt of raw water at Chandrawal. Thereafter, actual reading of raw water intake could commence only in July 2012, as one of the flow meters was out of order.

Similarly, measurement of potable water produced at Chandrawal was also not found reliable. Two methods of calculations were found recorded in the log sheets maintained at ChandrawalWTP-I, the first one was based on flow meter recordings and the other one on the rated capacity of the pumps used. It was seen during test check that the reading recorded for 24 hours on 26 July 2012 and 28 July 2012, by the flow meter was 36 MGD (on both days), while as per traditional method, water pumped out was 32 and 34.22 MGD respectively. Flow meters are considered to provide accurate and actual measurement of water that flowed through the pipeline, whereas reading based on rate of pumping tends to be higher than actual as pumps do not function technically at their 100 *per cent* efficiency. However, in this case, flow meter reading was more than that calculated on the basis of rate of pumping. On enquiry, the EE (E&M-I), stated (November 2012) that repeated complaints were placed with E&M (HP II) about the unrealistic and erratic readings shown by flow meters at both the works.

In case of Chandrawal-II, log sheets for potable water pumped out from the plant was maintained on the basis of capacity of pumps used and the duration of pumping. Since the pumps were very old and were functioning with decreased efficiency, the quantity of water worked out in the log sheets was not accurate.

In the absence of accurate information regarding raw water intake and potable water produced, audit could not derive assurance that the Chandrawal WTP was working efficiently and the wastage of water during purification process was within the permissible limits of eight to ten *per cent*.

The DJB stated (March 2013) that the flow meters are working properly now and the wastage during production is about eight per cent. However, Audit could not verify that the wastage was within permissible limits as there was no system for measuring wastage during treatment at the time of audit.

(b) Wastage of potable water due to defective valves and sluice gates

During visit to Chandrawal WTP-II on 18 to 21 June 2012 (three days), it was seen that the valves installed in the pipelines carrying potable water into the UGR from the filters were leaking continuously.

It was stated (July 2012) by the Executive Engineer that the valves and sluice gates on the filter beds of the plant were leaking as they were more than 57 years old and remained unrepaired/un-replaced due to budget constraints. Test check of log sheets revealed that the operational staff had recorded the necessity of immediate stoppage of major leakages in the sluice valves which also hampered proper cleaning of filters as the required pressure of potable water was not available. Inaction on the part of DJB in plugging the leakages indicates insensitivity towards wastage of precious potable water.

The DJB replied (March 2013) that replacing the sluice valves and gates without a holistic approach towards maintenance and rehabilitation plan is not advisable as it can result in disruption of services and therefore, the existing system is being maintained by incurring bare minimum expenditure. A complete rehabilitation of Chandrawal WTP and its command area is expected to be taken up by 2015. However, allowing leakage of precious potable water to continue, expecting it to be plugged during rehabilitation to be taken up in 2015 does not appear prudent.

(c) Non-removal of silt from River Yamuna at Wazirabad pond

The pond on Yamuna River bed is the source of raw water for Wazirabad and Chandrawal WTPs. Bhagirathi and Sonia Vihar WTPs also draw raw water from Wazirabad during closure for annual cleaning of Murad Nagar conduits which bring Ganga water from Uttar Pradesh to these plants. Records revealed that the deposit of silt reduces the capacity of pond as depth of water is reduced by three to four feet. Dredging of the pond was last carried out in July 2006. Although a proposal was mooted for de-silting by Executive Engineer (E&M-II) in September 2011, only administrative approval for the same was given by the Board and tender was yet to be called for as of January 2013. Delay in dredging resulted in reduction in capacity of the pond thereby depriving the DJB of any water reserve to meet emergency situations.

In its reply (March 2013), the DJB stated that since dredging is more prevalent in coastal areas, not much expertise exists in Delhi due to which it

took time to develop clarity on methodology and conditions to define scope of work. The reply is not convincing as dredging was carried out earlier also in the year 2006.

(d) Underutilisation of capacity of pumps

As per Energy Audit Report (December 2006) for WTP-I, Chandrawal, the operating capacity of two out of 10 pumps used for pumping potable water, were 57 *per cent* and 63.7 *per cent* respectively, which were below the designed efficiency of 85 *per cent*. The reasons for lower output were- (i) smaller size of delivery pipe due to which velocity of water in these pumps were more than acceptable limits and (ii) operation of the pumps at a higher head than the rated figure. The Energy Auditors recommended modification of delivery pipelines, but no action was taken by the DJB as of October 2012 resulting in underutilisation of the pumps.

The DJB replied (March 2013) that once the rehabilitation of Chandrawal WTP is complete, the issue will be resolved. The reply is not convincing as even after six years, no action was taken on the report that was prepared in 2006.

3.1.3.2 Process waste water recycling plants

During the process of producing potable water, WTPs produce waste water in the form of sludge from clarifiers and backwash from filters (water used to wash the filters). The average permissible wastage of water is eight to ten *per cent*. In order to augment the production of potable water, the DJB constructed four Process Waste Water Recycling Plants (PWWRP)as detailed in **Table 3.3.**

Table 3.3: Details of recycling plants

Sl. No.	Location	Capacity (MGD)
1	Chandrawal	8
2	Wazirabad	11
3	Haiderpur	16
4	Bhagirathi	10
Total		**45**

(a) Delay in commissioning of recycling plant at Chandrawal

DJB entered into an agreement (February 2007) with M/S Gannon Dunkerley& Co. Ltd. for construction of PWWRP with a capacity to produce eight MGD of raw water on turnkey basis at a cost of Rs 12.86 crore, with

stipulated date of commissioning as 30 June 2008 including three months trial run. The raw water produced by this plant was to be fed to the inlet of the main WTP.

The recycling plant was stated to be functional from 28 September 2012 and has been producing raw water since then. However, scrutiny of records revealed that the plant was producing only 4.70 MGD of raw water on an average during the period from September to October 2012 against its designed capacity of eight MGD. The plant was yet to be commissioned as of November 2012.

Thus, delay in commissioning of the recycling plant deprived the people of more than seven MGD of precious potable water for more than four years, considering wastage of eight *per cent* during treatment.

The DJB replied (March 2013) that the delay in commissioning was due to various reasons like extreme site constraints and high ground water table which impeded construction of deep chambers, demolition and reconstruction of chambers necessitated by insufficient space, hindrance in deep excavation due to other underground pipes etc. It was also stated that the plant is now fully commissioned. However, the fact remains that the plant was commissioned after a delay of more than four years. The site constraints and other difficulties could have been foreseen.

(b) Low production of water due to damaged waste water pipelines

The recycling plant at Wazirabad was required to produce 11 MGD of potable water after collecting waste water from the three 40 MGD plants. The plant was commissioned in December 2009. The pipeline carrying waste water from one of the plants was damaged in January 2010 and thereafter, waste water from only the remaining two WTPs was being utilised for production of raw water. Due to this, the average production of water by the recycling plant during January-June 2012 was reduced to 7.34 MGD against full capacity of 11 MGD. Though two years have passed, damaged pipe has not been repaired which resulted in short production of potable water to the extent of 3.66 MGD.

The DJB, in its reply (March 2013), stated that the pipe line bringing waste water from one of the plants crossed another pipeline for supply of water from Haiderpur to Wazirabad and vice-versa in emergency. Therefore, waste water pipeline required re-routing under the other pipeline and the work is likely to be completed within next two months. However, the reply did not explain why repairs/re-routing of a pipeline damaged in January 2010 was taking such a long time.

(c) Short production at recycling plant, Haiderpur

Two WTPs at Haiderpur of 100 MGD capacity each collectively produce about 16 MGD of waste water, for which a recycling plant of 16 MGD

capacity has been constructed by M/s Larson and Toubro Ltd., who was also entrusted with the operation and maintenance of the plant. The plant is in two parts. The first part converts the waste water into raw water and the second produces potable water from this raw water. As per the contract, 97 *per cent* of the waste water was to be converted into potable water.

Audit scrutiny of data of water produced during 12 months for the period from April 2010 to August 2011 (April to May 2010, August to October 2010, December 2010 to February 2011 and May 2011 to August 2011) revealed that during this period, the plant produced 4788 MG of potable water from 5464 MG of waste water. The wastage at the recycling plant was 12.37 *per cent* which was more than four times the permissible wastage of three *per cent*. The short production of potable water due to excessive wastage worked out to 1.4 MGD.

The DJB stated (March 2013) that the recycling plant is required to be operated at the peak efficiency for nine months in a year since during monsoon season, the efficiency will reduce due to increase in turbidity in the raw water which affect recovery of water at the recycling plant. The reply is not correct since the plant was not giving the desired output in any of the months for which data was provided to Audit.

3.1.3.3 Qualityof potable water

The DJB has water testing laboratories at all WTPs, beside six Zonal laboratories to ensure quality of potable water as per BIS norms. The laboratories conduct chemical and bacteriological analysis of water from WTPs, reservoirs, samples from private bodies/individuals, tube wells, Deep Bore Hand Pumps, Ranneywells and other sources.As part of thematic audit, records of Quality Control Laboratory, Wazirabad was examined. Audit findings are discussed in the succeeding paragraphs.

(a) Shortage of manpower

As per information made available to audit, against sanctioned strength of 180 for quality control, only 118 regular staffs beside 16 technicians on contract basis, were available leaving a shortage of 46 staff.

(b) No corrective measures on deficiencies reported in test reports

In addition to its own laboratories, DJB has also engaged the services of National Environmental Engineering Research Institute (NEERI), a government agency, to conduct third party quality checks of potable water. Corrective measures are to be taken by Zonal Engineers on deficiencies pointed out in reports of field laboratories and NEERI. Audit observed delays in taking remedial action by Zonal Engineers on reports forwarded by the Field and Zonal Laboratories and NEERI indicating absence of an effective internal control mechanism within the DJB.Out of 19 cases pertaining to the period from July 2011 to September 2011 test checked, in five cases, no

remedial action was found to have been taken by the Zonal offices on rechecking. As a result, substandard potable water was used by the public.

The DJB replied (March 2013) that since the city has intermittent water supply system, period of physical checking and collection of water samples gets restricted. Due to these reasons, corrective measures to restore water supply becomes time consuming. Steps are being taken to improve upon it.

3.1.4 Distribution of potable water

With a per capita requirement of 60 gallons (274 litres) of water per day including domestic, institutional, industrial and fire service requirement, the total requirement of potable water for Delhi works out to 1025 MGD, against which the DJB produces and distributes about 818 MGD of potable water, the shortage being 20.02 *per cent.* Nevertheless, the management of distribution of water by DJB was found to be deficient on various counts as discussed in the succeeding paragraphs.

3.1.4.1 Irrational assignment of jurisdictional areas to Divisions for supplying potable water

In Delhi, six WTPs cater to the water need of the population of individual command areas. Potable water is initially pumped through transmission lines into Underground Reservoirs (UGRs) located in command areas, from where it is further pumped into smaller UGRs and then distributed to households through distribution lines with the help of booster pumps. Pumping of water into various UGRs and distribution lines is managed by nine E&M divisions of the DJB whereas distribution lines are maintained by 22 civil divisions. Audit observed that the allocation of jurisdictional areas amongst various divisions, E&M as well as Civil, was done on the basis of Assembly Constituencies. Consequently, each division has to cater to two or more constituencies. In this set up, some E&M divisions receive water from two or more WTPs and most of them supply water to more than one civil division making it difficult to track the flow of water from WTPs to the users. Similarly, individual civil division get water supply from more than one E&M division. In some cases, water from one UGR is supplied to areas under more than one civil division. Some time, a single distribution line covers parts of two civil divisions also. In this scenario, water supplied to each division is not measurable, making proper management and distribution of available potable water ineffective and inefficient respectively. Due to the complicated system of distribution, water is not supplied to divisions according to the population of the area under their jurisdiction. As such, the present allocation of distribution work amongst various divisions is not conducive to efficient water management and equitable distribution of potable water to the population of Delhi. A proper distribution of jurisdictional areas will also aid in making individual civil division accountable for water received, distributed, distribution loss, non-revenue water, etc.

In reply, the DJB stated (March 2013) that the management deficiencies were largely because the city had been growing partly in an unplanned manner. It was further stated that the concept of district metering area was being implemented through which it would become possible to account for the water supplied and consumed in the command of specific water facility. It would also help in distributing water more evenly and reduce non-revenue water.

Planning process of DJB should have taken into account the population growth patterns and expansion of the city. Further, as regards implementation of the concept of district metering area, the DJB has not given any time frame for the same.

3.1.4.2 Population not receiving piped water

As per information available from census 2011, 24.8 *per cent* of the households in Delhi were not receiving piped treated water. As per information furnished by 15 out of 22 civil divisions, a population of 32.53 lakh not covered through pipelines, was supplied with 1000.94 MG of water through tankers during the year 2011-12 with average per capita supply of 3.82 litres per day against a prescribed norm of 172 litres per capita per day for domestic use. The details are in **Annexure-3.1**.

The DJB stated (March 2013) that tanker supply is an emergency supply to meet drinking water needs only and for non-potable purposes, water demand is met through ground water resources in the areas. However, the fact remains that DJB failed to supply adequate piped treated water to 24.8 *per cent* of households in Delhi.

3.1.4.3 Short supply/non-availability of water in areas at tail end of distribution lines

Audit observed that DJB was also supplying water through tankers to areas connected by distribution lines. The reason for this was shortage of water in those areas due to installation of online booster pumps by consumers. As per information furnished by 11 civil divisions, more than seven lakh people were affected due to shortage of water in areas covered through distribution lines. On this issue, DJB stated that although installation of on line booster pumps by consumers is not permitted, action is taken only when a specific complaint is received. DJB's approach towards removal of illegal online boosters was not proactive, even though this was affecting proper distribution of potable water.

In reply (March 2013), the DJB stated that three magistrates had been appointed for taking action against those who indulge in installation of online boosters and illegal tappings but this drive needed to be pursued more to address the problem of shortage of water in tail end areas. However, the reply is silent about concrete action plan and time frame for addressing this issue.

3.1.4.4 Non-accountability of water supplied

The distribution of potable water is the responsibility of civil divisions which maintain distribution lines and attend to consumer grievances, complaints relating to short supply, unauthorized connections, installation of meters etc. However, there is no system in DJB to measure the quantity of water received by each division and actually distributed to consumers. Due to this, DJB is not in a position to determine accountability with regard to wastages, leakages, non-revenue water etc.

Although a project for installation of 305 flow meters was launched in July 2007 with scheduled date of completion as 18 July 2009, only 284 meters were installed till May 2012. Further, information from these flow meters is not of much use as it does not give quantity of water supplied to individual divisions.

The DJB stated (March 2013) that once the entire network is divided into district metering areas, it would be possible to account for the water supplied and consumed. However, the DJB has not given any specific details of schedule of implementation.

3.1.4.5 Water trail from Nangloi WTP

The water trail from Nangloi WTP was analysed in detail in audit to illustrate the deficiencies in distribution system. The Nangloi WTP produces approximately 40 MGD of water and supplies to areas under four civil divisions through two E&M Divisions. Water from the WTP is also being supplied to IGI Airport and to DDA.

There are two transmission lines emanating from the WTP, one towards Pappankalan and the other towards Najafgarh. The Pappankalan line supplies water mostly to areas under West III division through three primary UGRs at Hastal village, Bodella and Panchwati. Apart from these, there is one more UGR, Command Tank-2 (CT-2) being maintained by the DDA served by this line. Seven distribution lines also branch out from the transmission lines which supply water directly to Vikas Nagar, Mundka, Nagloi, Dabri, Fish Market, Vishwas Park and MatialaVillage. Further, there are 12 smaller UGRs under Bodella main UGR which supplies water to Vikaspuri area. A map of distribution lines emanating from the WTP is placed at **Annexure-3.2.**

Pumping of water from various UGRs is handled by two E&M divisions viz. West and South West divisions. Apart from water from Nangloi, West Division also handles water from Haiderpur and Wazirabad WTPs. Similarly, South West Division also handles water from Haiderpur and Sonia Vihar. Further, areas under three out of four civil divisions which receive water from Nangloi,also receive water from Haiderpur WTP. This is due to the fact that the jurisdictional areas of civil divisions have been allocated on the basis of Assembly constituencies. One distribution line from Bodella UGR branches

into two and both the branches supply water to areas under both West-I and West III divisions. Similarly, water from CT-2 (DDA UGR) is supplied to areas under West-I, West-III and South West I divisions through a single distribution line which snakes through all these divisions. In this set up, water received by each civil division can not be measured.

As per information furnished by the four civil divisions receiving water from Nangloi WTP, the total population in the command area of WTP Nangloi was 23.47 lakh. Since average production of water at the WTP was 40 MGD, per capita availability of potable water per day works out to 77.36 litres. However, per capita supply of water to different areas under the WTP ranged from 3.36 litres per day to a population of 2.5 lakh under the Daulatpur UGR to 224.61 litres to a population of 1.9 lakh in Nangloi area being fed directly from the transmission line. Areas under Daulatpur and Ujwa UGRs were getting water from WTP only once in two days. Details of area wise population, water supply and per capita supply in the command area of the WTP are given in **Annexure-3.3**. Per capita supply position of potable water to different areas is given in **Table 3.4.**

Table 3.4: Per capita supply position of potable water

Sl. No.	Per capita supply per day	Population
1	Below 20 litres	5.73 lakh
2	20 to 50 litres	8.79 lakh
3	50 to 75 litres	3.32 lakh
4	75 to 100 litres	1.34 lakh
5	100 to 150 litres	0.40 lakh
6	Above 150 litres	3.90 lakh

As can be seen, the distribution of water to the population was far from equitable. It was also observed that the areas which were receiving excess water, i.e. Nangloi and Mundka, were being supplied water directly from the transmission lines near the WTP. This indicates that there is no regulation of water supply in areas where the water is supplied directly from the transmission lines.

Although all the four divisions furnished population served by each UGR/distribution line, these figures were stated to be based on the voters list of the area. Therefore, the population figures are only an approximation and not actual. In the absence of reliable data, the DJB was not in a position to ensure distribution of water according to actual requirement in different areas.

The DJB, in its reply (March 2013), stated that large number of unauthorized growth in unplanned colonies came up in West and South West Delhi due which the water supply in its command area became un-rationalised. Some of the areas presently being fed from Nangloi WTP were to be transferred to command of other WTPs. It was also stated that the DJB had taken up a project under PPP module so that 24 hours water supply at adequate pressure is available in all the households.

The reply gives reasons for deficiencies in distribution and DJB's plans for resolving them. However, no specific time frame has been given as to when the problems of shortage of water and inequitable distribution would be resolved.

3.1.4.6 Deficiencies in water trail from Chandrawal WTP through distribution lines to end users.

There are six civil divisions that receive water from Chandrawal WTP (Central-I, Central-II, North-I, North West-IV, South West-III and West II). They also receive water from Wazirabad WTP and Haiderpur WTP and have 65 UGRs under their control. There are 10 main UGRs receiving water from Chandrawal WTP and supplying to distribution lines. Examination of water trail from Chandrawal WTP revealed the following deficiencies:

(a) Non utilisation of UGR at Palam

Apart from the operational UGR at Palam, there is one more reservoir of 2.4 MG to supply water when the operational UGR is shut down for cleaning etc. This additional reservoir was repaired in 2004-05 at an approximate cost of ₹ 80.00 lakh but was not handed over to E&M Division by Civil wing (October 2012) after repairs, resulting in non-utilisation of this reservoir.

In its reply (March 2013), the DJB stated that the reservoir would be used shortly for NDMC supplies. However, the fact remains that a reservoir repaired at a cost of ₹ 80 lakh remained unused for eight years.

(b) Absence of actual data on population and quantity of water supplied to different areas

In North West-IV, West-II & South West-III divisions, the data on population of their command areas is not maintained while in Central-I, II & North-I divisions, the respective Executive Engineers stated that the methodology of determining the population of the command areas was based on the voters list of area.

Further, in most of the cases, quantity of water supplied from each UGR was calculated on the basis of capacity of booster pumps and the duration of pumping. Even where flow meters were installed, data from such flow meters were not being used by Divisions.

The DJB replied (March 2013) that the issue would be resolved once the proposed rehabilitation of Chandrawal WTP is done. Thus, there is no definite time bound action plan.

Revenue earnings

3.1.5.1 Metering of water supply

In order to keep a watch on consumption patterns and realisation of revenue, proper measurement of supply of water for domestic, commercial and industrial purposes is essential.

As per information furnished by DJB (August 2012), there were 19.64 lakh connections out of which 6.79 lakh were un-metered/without functional meters which constituted about 35 *per cent* of the total connections. Apart from ensuring proper realisation of revenue, metering will also increase efficiency in use of water, detection of leakages in the system and enable high end consumers to be charged for extra consumption. Supply of water to such a large number of consumers without meters/with defective meters is detrimental to optimum utilisation of the available potable water apart from depriving DJB of revenue.

In its reply (March 2013), the DJB stated that it had sanctioned a proposal for procuring and installing eight lakh domestic water meters meeting international standards and tenders for procurement of four lakh water meters had already been received. However, the reply is silent as to when the DJB would be able to achieve metering of remaining water connections.

3.1.5.2 Non-revenue water

Non-revenue water is water which does not earn any revenue. This could be due to different reasons like unauthorised consumption through illegal connections, water theft, metering inaccuracies, authorised consumption not billed such as public taps and also real losses through leakages in the transmission and distribution networks. Reduction in non-revenue water will not only improve financial sustainability of the DJB but also reduce loss of water which can be used to meet currently unsatisfied demand or future demand of potable water.

In terms of Ministry of Urban Development, GoI Handbook on Service Level Benchmarking, the acceptable extent of non-revenue water is considered as 20 *per cent*. However, the extent of non-revenue water in DJB was more than three times the prescribed limit during last three years as shown in **Table 3.5.**

Table 3.5: Extent of non-revenue water

Year	Water produced (MGD)	Water billed (MGD)	Non-revenue water (MGD)	Percentage of non-revenue water
2009-10	800	264.24	535.76	66.97
2010-11	835	293.94	541.06	64.80
2011-12	818	306.00	512.00	62.59

This issue was also highlighted in the Comptroller and Auditor General's Report on Government of NCT of Delhi of 2008 but there was no improvement in the situation as the extent of non-revenue water was pegged at 64.78 *per cent* in 2006-07. This indicates that DJB lacks seriousness in intent to tackle the problem of excessive non-revenue water.

The DJB stated (March 2013) that high non-revenue water in Delhi was largely attributable to unregistered consumers residing in JJ Clusters/Unauthorised/Unplanned areas which were yet to be covered by the planned network. Further, as per Government Policy, water supplied through tankers and from tubewells is not billed. However, the DJB has not provided any data relating to the effect of these factors on non-revenue water. Further, the extent of water supplied through tankers and tubewells was less than 15 *per cent* whereas the extent of non-revenue water was more than 60 *per cent*.

3.1.5.3 Loss of revenue amounting to ₹ 3950.90 crore due to short billing

The details of potable water produced, quantity to be billed (at 80 *per cent* of total production), quantity actually billed, average tariff and revenue loss due to short billing, during last three years were as shown in **Table 3.6.**

Table 3.6: Details of revenue loss

Year	Average production (MGD)	Quantity to be billed as per norms (MGD)	Average quantity billed (MGD)	Billed amount (₹ in crore) per year	Average tariff per MG (₹ in crore)	Revenue loss due to short billing (₹ in crore)
2009-10	800	640	264.24	971.39	3.68	1382.80
2010-11	835	668	293.94	926.17	3.15	1178.29
2011-12	818	654.40	306.00	1217.36	3.98	1389.81
					Total	**3950.90**

As can be seen, high percentage of non-revenue water resulted in loss of revenue of ₹ 3950.90 crore during the last three years.

3.1.5.4 Collection of arrears

Billing should be followed by collection of revenue against bills raised. Inefficient revenue collection results in accumulation of arrears. Year wise details of arrears of revenue at the beginning of the year, bills raised during the year, targeted collection, amount actually collected and arrears at the end

of the year during the years 2009-12 are given in **Table 3.7.**

Table 3.7: Details of arrears of revenue

(₹ in crore)

Year	Opening balance	Addition during year	Revenue target	Revenue collected	Arrears
2009-10	881.66	971.39	470.00	670.11	1182.94
2010-11	1182.94	926.17	805.55	924.86	1184.25
2011-12	1184.25	1217.36	1100.00	1202.47	1199.14

The above table indicates that in spite of achieving the targets fixed for revenue collection every year,the arrears amount has been increasing consistently. Scrutiny of records revealed that DJB arrived at the projected billing amount for 2012-13 by increasing last year's billed amount by 10 *per cent*. The target for revenue collection for 2012-13 was fixed at 75 *per cent* of this projected billing along with 10 *per cent* of arrears (8-10 years old) and 15 *per cent* (remaining arrears). Accordingly, the projected billing for 2012-13 was ₹ 1339.10 crore whereas the target fixed was ₹ 1300.28 crore. Fixing of target for revenue collection including arrears below the projected billing is not realistic since achieving this target would not reduce the arrears of revenue.

3.1.6 Public perception regarding service provided by DJB

3.1.6.1 Public opinion

To ascertain public perception on the quality of services provided by DJB, a questionnaire was sent to randomly selected 584 RWAs out of 1947 registered RWAs in Delhi. The questions sought information onthe duration of availability, sufficiency andquality of water supplied, the complaint redressal mechanism etc. Analysis of responses received from 111 RWAs revealed that:

- *Sixty four RWAs received water for less than two hours a day in summer season and 59 RWAs received water for less than two hours a day in winter season.*
- *Eighty seven RWAs did not receive sufficient water in summer season and 71 out of 87 RWAs did not receive sufficient water in other seasons also.*
- *Fifty nine RWAs felt that the water was unfit for drinking In summer season while 51 RWAs felt the same in winter season.*
- *Seventy eight RWAs were not satisfied with the complaint redressal mechanism of DJB.*

Thus, the outcome of survey strengthens audit conclusions regarding shortage of water and unequal distribution of water discussed in paragraphs 3.1.4.2, 3.1.4.3 and 3.1.4.5.

3.1.6.2 Redressal of public grievances

The Central Control Room (CCR) maintains Register of Complaints to record complaints received from the general public on various issues like no water,request for tanker, dirty water, sewerage blockage, leakage/burst, unauthorized water connection etc. Out of 56,806 complaints received between April 2009 and June 2012, entries in respect of 21698 complaints were test checked in audit. It was noticed that in 62.60 *per cent* of cases, remedial action was not recorded while in 15.39 *per cent* cases, action was either recorded late or no date was recorded. Only in 22.01 *per cent* cases, the entries reflected satisfactory action.

The DJB stated that although the complaints were sent to the Water Emergencies (units functioning under each civil division) concerned, records at CCR remained blank due to non receipt of feedback in most of the cases from them. In the absence of proper entries in the register, audit could not ascertain whether all the complaints were attended to in a timely manner.

3.1.7 Absence of Management Information System

Availability of timely, accurate and reliable data is of paramount importance for efficient functioning of any organization. It was observed that DJB has no management information system in place to collect and analyse data relating to requirement of water, production and distribution of potable water etc. In the absence of real time information, each WTP produces and supplies water to its command area on pre-determined quantities, irrespective of the actual demand. Further, in the absence of data relating to water received and billed by each civil division, the problems of transmission losses, non-revenue water, inequitable distribution of potable water etc. continue to persist.

In its reply, the DJB has stated (March 2013) that it had implemented various IT based projects such as FMS (for budget allocation), PMS (for project monitoring), RMS (for revenue monitoring) etc. and efforts were being made to integrate these through the common monitoring system. The reply does not cover the issue of collection and analysis of data relating to requirement of water, production and distribution of potable water.

Conclusion

The raw water available to Delhi is not sufficient to provide potable water to the whole population of Delhi. Construction of dams up river for augmentation of raw water in Delhi would take 6-7 more years to complete. The production of potable water by WTPs was found to be below the designed capacity. Due to absence of a proper measurement system, it could not be ascertained whether the wastage of water during treatment at Chandrawal was within permissible limits. The eight MGD recycling plant at Chandrawal was commissioned after a delay of more than four years whereas the recycling plant at Wazirabad was working below its capacity due to damage in pipeline.

Production of potable water at Haiderpur recycling plant was also found to be sub-optimal.

The DJB has neither a proper measurement system to measure water supplied to different areas nor reliable data about the population in different areas to regulate supply of water equitably. The allocation of jurisdictional areas among divisions was not conducive to efficient water management and it was not possible to measure water received and distributed by each division. In the absence of proper measurement system, there was no accountability for the water received in each division. Also, the distribution of potable water was not equitable with per capita supply ranging from three litres per capita per day to more than 300 litres per capita per day. Further, 25 *per cent* of the households in Delhi were receiving drinking water through tankers instead of pipes. The per capita supply to this population was only 3.82 litres per day against a prescribed norm of 172 litres. Metering of water supply at consumer end was not comprehensive due to which the non-revenue water, i.e. water which do not fetch any revenue remained more than 60 *per cent* during the last three years.

Recommendations

- *The DJB may pursue the matter of construction of dams up river on Yamuna so that adequate raw water is available to Delhi at the earliest.*
- *The DJB may ensure optimum utilisation of available raw water by optimising production at recycling plants at Wazirabad and Haiderpur.*
- *The DJB may strengthen manpower of its Quality Control Wing to properly monitor quality of drinking water.*
- *The DJB may endeavour to ensure supply of piped water to the whole of Delhi by laying adequate distribution lines.*
- *The DJB may put in place systems for measurement of water at each WTP, UGR and distribution line in order to make measurement of process wastage, equitable distribution of water, controlling of wastage and non revenue water possible so that each division remains accountable for the management of water.*
- *The DJB may endeavour to cover maximum population for fixation of water meter at consumer end so that wastage of water by consumers is minimised and revenue is maximised.*
- *The DJB may put in a place a Management Information System to collect and analyse data relating to production and distribution of potable water.*