

## Chapter 3

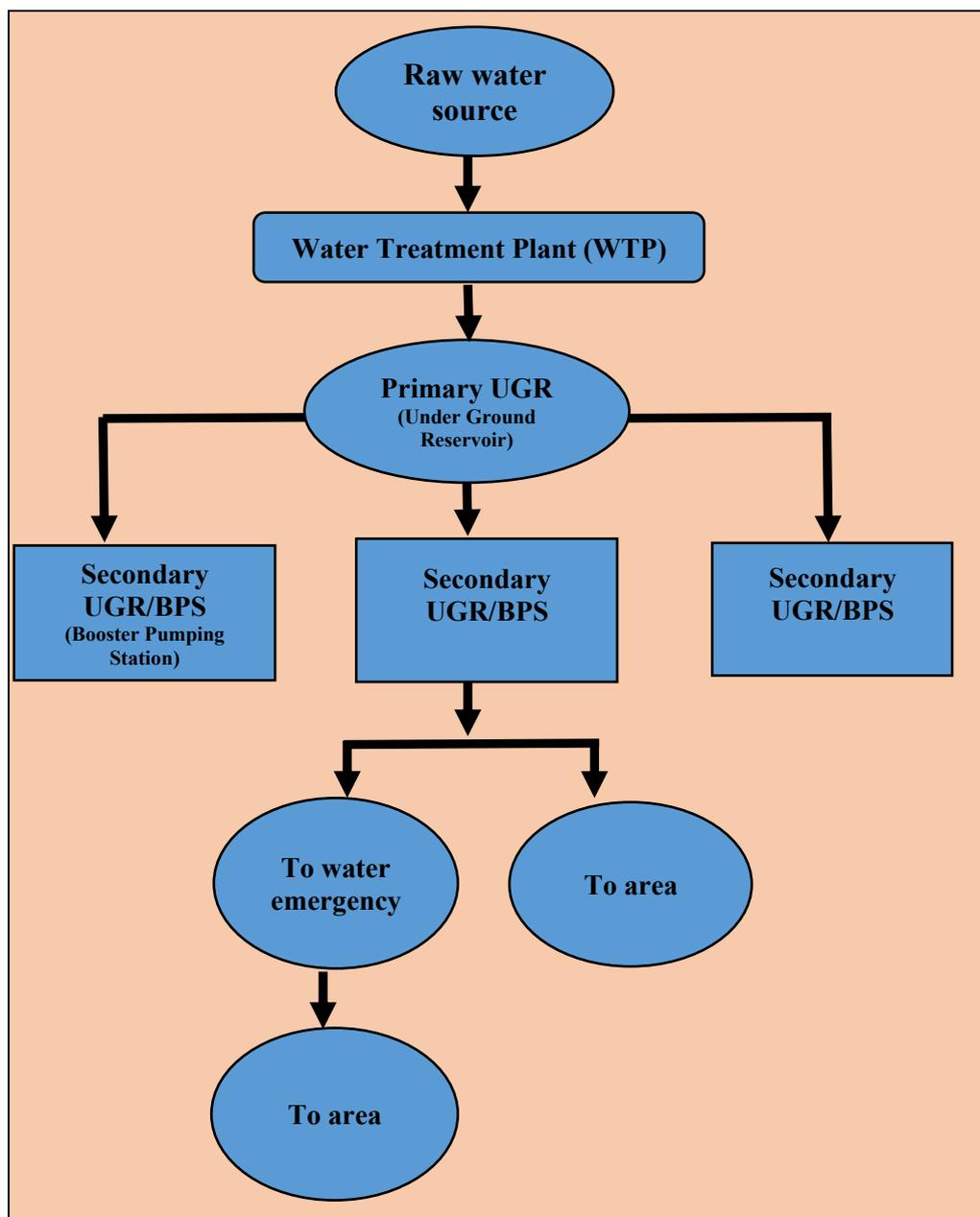
### Water Supply and Distribution System

DJB has increased production of potable water from 883 MGD (2017-18) to 935 MGD (2021-22) i.e. 52 MGD; however, total water available for distribution could be increased by only 3.81 MGD. The gap of total water produced and total water distributed increased from 16 *per cent* (2017-18) to 21 *per cent* (2021-22). There was continuous water wastage due to leakages at various UGRs (Underground Reservoirs)/BPSs (Booster Pumping Stations). DJB could not achieve planned aim of replacement of old water distribution lines to ward off losses due to leakages. There was absence of an effective monitoring mechanism in DJB so as to ensure that testing of water samples was done as per fixed parameters/standards. The risk of theft, pilferage and diversion was also high due to the absence of GPS-based monitoring system in the majority of the tankers.

The primary objective of DJB is to provide potable water that has passed through all water quality testing at a reasonable economic price to the residents of Delhi. DJB is also required to take suitable steps to ensure proper supply of water by regularly upgrading and augmenting its supply pipeline network by replacing old pipelines, laying new pipelines, and having a robust leakage management system.

The distribution system of water is depicted in **Diagram 3.1**.

Diagram 3.1: Water distribution system



DJB has 15,383 KM of piped water supply network for the distribution of treated drinking water to the residents of Delhi. The entire area of Delhi is divided into 11 Zones for all maintenance works etc. Each zone is headed by an Additional Chief Engineer (Civil/ E&M).

Audit observed shortcomings in the supply and distribution of available potable water as discussed in the succeeding paragraphs.

### 3.1 Transmission loss/leakages of water and inequitable supply of potable water

During 2017-22, the details of total potable water produced and distributed from the UGRs is given in **Table 3.1**.

**Table 3.1: Transmission loss of water**

Year	Production of water (in MGD)	Water distributed from UGRs (in MGD)	Transmission loss of water / Water unaccounted for (per cent)
2017-18	883	739	16.31
2018-19	896	740	17.41
2019-20	923	741	19.72
2020-21	928	742	20.04
2021-22	935	742.81	20.56

Source: Information provided by DJB

It can be seen from **Table 3.1** that during 2017-22, the gap of total water produced, and total water distributed from OHTs/SRs<sup>1</sup>/UGRs increased from 16 *per cent* (2017-18) to about 21 *per cent* (2021-22). This indicates that DJB has not taken effective steps in reducing the transmission loss of water from WTPs to SRs/OHTs/UGRs.

It can also be seen that though the production of potable water increased by 52 MGD (5.89 *per cent*) from 883 MGD (2017-18) to 935 MGD (2021-22), the total water available for distribution increased by only 4 MGD (0.52 *per cent*) during the said period. This loss of water/water unaccounted for may be due to transmission loss, leakages, theft, unauthorized diversion, etc. Thus, the overall increase in the distribution of potable water was not commensurate with the increase in the supply of potable water.

Audit could not ascertain the quantity of loss during the supply of water from the UGRs to the consumers, as information/records in this regard were not provided. However, after considering the distribution loss, the water finally reaching the consumers would invariably show more shortfall.

The matter was referred to the Government in July 2023, reply was awaited (April 2025).

***Recommendation 6: Government should ensure that DJB frames specific guidelines for Water audit and regularly conduct the same to evaluate the existing water supply system to minimise the transmission loss of water from the WTPs to SRs/OHTs/UGRs.***

### **3.1.1 Shortage and inequitable supply of potable water at zonal level**

(a) The year-wise details of the distribution of water supply from UGRs to various zones are given in **Annexure 3.1**. The summarised position of per capita water supply to different zones under respective Additional Chief Engineers (ACEs)/ Chief Engineers (CE) is given in **Table 3.2**.

<sup>1</sup> OHT = Over-head Tanks, SR = Service Reservoirs (same as Under Ground Reservoirs (UGRs)).

**Table 3.2: Per capita water supply in 11 ACE(M)s and CE(W)Pr.-I**

Per capita water supply range in 2021-22 (GPCD)	No. of ACEs/CEs providing water in the range	List of ACE(M)s/CEs
<20	4	ACE(M)-2, ACE(M)-4, ACE(M)-7, ACE(M)-11
>=20 and <30	2	ACE(M)-1, ACE(M)-5
>=30 and <38	6	ACE(M)-3, ACE(M)-6, ACE(M)-8, ACE(M)-9, ACE(M)-10, CE (W) Pr.-I

Source: Data provided by DJB

As is evident from **Table 3.2**, the average water supplied in the year 2021-22, besides being inequitable amongst the various localities of Delhi, was also way lower than the requirement of 60 (GPCD). Further, the shortfall was more severe in the localities like Seemapuri, Burari, Mehrauli when compared to localities like Rajouri Garden, Greater Kailash, Malviya Nagar, indicating a skewed distribution of water supply.

The above status indicates the failure of DJB in supplying water equitably to the residents of Delhi during the period 2017-18 to 2021-22. Such high shortfall indicates that DJB has not been able to deliver evenly the water treated by WTPs to the population of Delhi.

(b) During 2017-22, test checks of records of six Divisions revealed that in all the Divisions, average percentage shortfall in supply of water ranged from 26.91 *per cent* (West-I division) to 38.05 *per cent* (South West-II division) except South-II division. In South-II division, the average percentage shortfall was around 12 *per cent* from being surplus in 2017-18.

During the Exit Conference, DJB assured that necessary steps would be taken to reduce the quantity of transmission loss of water.

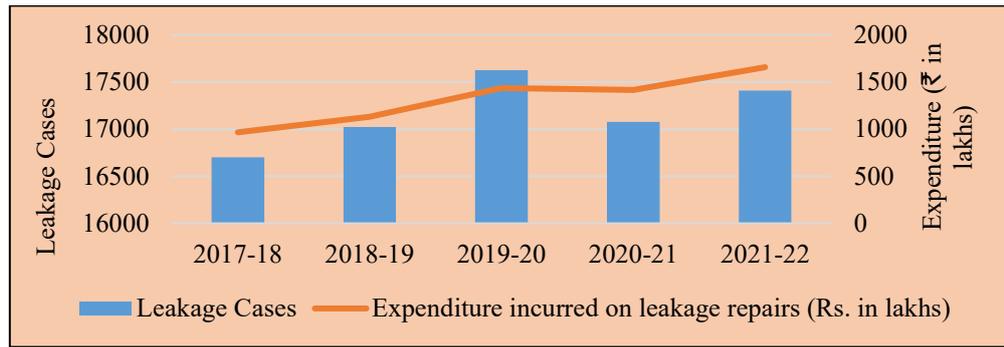
### 3.1.2 Water leakage management

As per Economic Survey of Delhi of 2021-22, DJB estimated that the total distribution losses, which includes leakage in pipes and theft of water through unauthorized connections, are of the order of 45 *per cent* of the total water supply. Leakages are detected through inspection/survey by the Leak Detection and Investigation Cell (LDI Cell) and also from complaints from public. The leakages are to be attended to by the Maintenance Division concerned as soon as they are detected and Action Taken Reports (ATRs) sent by divisions are to be compiled by the LDI cell. The LDI survey teams also check whether the leakages reported earlier are attended by the divisions or not.

Analysis of the data related to ‘Leakage cases’ provided by DJB relating to the 11 ACE(M)s<sup>2</sup> has revealed that the number of cases of leakage has shown a generally increasing trend (**Chart 3.1**).

<sup>2</sup> Nil data provided for ACE(M)-6; CE(W)Pr-1 has not provided complete data (expenditure not provided), hence data for CE(W)Pr-1 has not been included in total.

Chart 3.1: Increase in Leakage Cases



DJB did not furnish to Audit any work plan for conducting leak detection surveys/inspections based on the age of pipelines, susceptibility to leakages, topography, etc. Other shortcomings are as under:

- i. Audit noted that no new equipment was procured by LDI Cell during the years 2017-18 to 2021-22. LDI Cell had only four functional equipment (as on 31st March 2018), which were reduced to two during the year 2021-22. Resultantly, the number of inspections/surveys for leakage detection by the LDI Cell had decreased by 85 per cent during 2017-22, as shown in **Table 3.3**.

Table 3.3: Leakage detections by LDI Cell and ATRs submitted

Year	Number of inspections/surveys done by Leak Detection Cell	Number of Leakages detected by leak Detection Cell	No. of detection cases in which Action Taken Reports (ATRs) were submitted by concerned division	Percentage of detection cases in which ATRs submitted
2017	1387	1387	5	0.36
2018	1033	1033	85	8.23
2019	1192	1192	68	5.70
2020	803	803	3	0.37
2021	478	478	1	0.21
2022*	204	204	0	0.00

\* Data till 31<sup>st</sup> March 2022 only

Source: Data provided by DJB

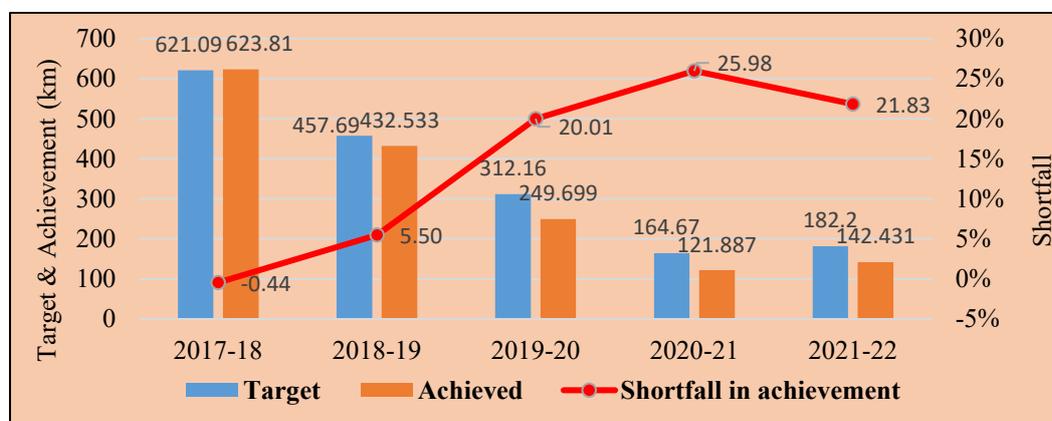
- ii. The number of inspections conducted tallied with the leak cases detected. This indicates that inspections were restricted to only confirm cases of leaks and there was no preventive leak detection work being carried out.
- iii. Further, there was no monitoring of action taken by the divisions in resolving leakages pointed out by the LDI Cell as ATRs were seldom submitted by the divisions concerned.
- iv. The format of the ATR was deficient as it did not contain crucial monitoring parameters viz the date of leak detection by LDI, date of leak resolution by the division etc. In the absence of such details, Audit could not ascertain whether prompt action was taken by the concerned divisions.

The matter was referred to the Government in July 2023, reply was awaited (April 2025). During the Exit Conference, DJB accepted the shortage of equipment in LDI Cell and assured that additional equipment and manpower would be provided to LDI Cell, and proper planning would be done to substantially increase the number of inspections/surveys.

### 3.2 Laying of new water pipelines and replacement of old pipelines

(i) While DJB has been fixing targets for laying new water lines, it did not provide records about the process/criteria adopted by it for fixing these targets. In the absence of relevant records, it could not be ascertained whether the targets fixed were part of any planned activity or ad hoc. The target vis-à-vis the achievement of laying of new water distribution lines during 2017-18 to 2021-22 is shown in **Chart 3.2**.

**Chart 3.2: Targets and achievement for laying of new distribution lines**



Source: Data provided by DJB

As can be seen from **Chart 3.2**, the percentage shortfall against the laid down targets for new pipelines during the review period continuously increased, except in 2021-22, wherein the shortfall was marginally lower. What is also significant is that the overall target for new lines had also drastically reduced by 71 per cent during the period under report.

Analysis of overall zone-wise data of new water distribution lines laid during 2017-18 to 2021-22 revealed that in three<sup>3</sup> out of 12 ACEs/CE (W Pr.-I) Zones, the shortfall against the target of laying new lines was more than 25 per cent.

(ii) As per the Economic Survey of Delhi 2020-21, a significant portion of water pipelines in Delhi are as old as 40 to 50 years and thus prone to higher leakage losses. Details are given in **Table 3.4**.

**Table 3.4: Age analysis of water supply pipelines**

Age of water pipeline	0-20 Years	20-40 Years	>40 Years
Length of water pipeline (in km)	6181.34 (50%)	4718.82 (39%)	1308.53 (11%)

Source: Data provided by DJB

<sup>3</sup> ACE(M)-3, ACE(M)-5, ACE(M)-10

It can be observed that around 11 *per cent* of the pipelines are more than 40 years old. It is pertinent to mention here that since data relating to only 12,000 out of 15,000 km of pipelines was provided to Audit, the length of pipelines older than 40 years might be higher than the figures mentioned above.

However, DJB's approach towards the replacement of old pipelines lacked impetus. Analysis of ACE (M)-wise data provided by DJB in respect of "Replacement of old water distribution lines" revealed that there was an overall shortfall in achievement of targeted replacements of around 8.38 *per cent*. Here too, there was nothing on record to show the rationale behind fixing of yearly targets, nor was there any SOP/Plan regarding phased replacement of water pipelines after defined time periods.

The matter was referred to the Government in July 2023, reply was awaited (April 2025).

### 3.3 Revenue Losses due to Non-Revenue Water

Non-Revenue Water (NRW) is defined as the extent of water produced which does not earn any revenue to the organisation. This is computed as the difference between the total water treated and supplied by WTPs and the total quantity of water billed, expressed as a percentage of the total water treated and supplied. As per the Ministry of Urban Development, Government of India's 'Handbook of Service Level Benchmarking', NRW comprises: (a) consumption which is authorised but not billed; (b) apparent losses such as illegal water connections, water theft and metering inaccuracies; and (c) real losses like leakages in the transmission and distribution networks. As per the Handbook, the benchmark value for NRW may be considered at 20 *per cent*.

During the period 2017-18 to 2021-22, the average quantity of total treated water supplied was 883 MGD during the year 2017-18, which increased to 935 MGD during the year 2021-22. The details of treated water supplied, billed quantity of water and NRW for the period 2017-18 to 2021-22 is given in **Table 3.5**.

**Table 3.5: Treated water, billed water, NRW and loss of revenue on account of NRW beyond benchmark value**

Year	Average quantity of treated water supplied per day (in MGD)	Billed quantity of water supplied per day (in MGD)	Non-Revenue Water (NRW) per day (in MGD)	Percentage of NRW w.r.t. supplied treated water (per cent)	Revenue earned by DJB by billed quantity of water (₹ in crore)	Estimated amount of revenue loss due to NRW beyond benchmark value <sup>4</sup> (₹ in crore)
(i)	(ii)	(iii)	(iv) = (ii) – (iii)	(v) = (iv)/(ii)*100	(vi)	(vii) = {(vi)*0.8*(ii)/(i ii)} - (vi)
2017-18	883	421	462	52.32	1662.35	1126.92
2018-19	896	419.92	476.08	53.13	1824.35	1289.80
2019-20	923	524.91	398.09	43.13	1705.41	693.62
2020-21	928	457.07	470.93	50.75	1682.23	1050.15
2021-22	935	450.39	484.61	51.83	1252.85	827.86
<b>Total</b>						<b>4,988.35</b>

Source: Information provided by DJB

As it is evident from **Table 3.5**, the percentage of NRW was in the range of 51 per cent to 53 per cent during the period 2017-18 to 2021-22 (except for the year 2019-20) as against the acceptable level of upto 20 per cent. However, there was nothing on record to show that DJB made any efforts to reduce the NRW. Reduction in NRW to an acceptable level is also vital for the financial sustainability of DJB. Even after considering an allowance of 20 per cent as NRW, DJB should have collected Revenue corresponding to 80 per cent of the water produced. The potential revenue loss on account of NRW beyond the benchmark for the review period was to the tune of ₹ 4,988 crore.

During the Exit Conference, DJB, while accepting the audit finding, intimated that necessary efforts were being made to reduce the Non-Revenue Water.

### 3.4 Inadequate monitoring of water quality

DJB has set up eight water testing laboratories in Delhi, which function under the Director (Testing and Quality Control). These laboratories check the quality of drinking water being supplied. In case the water samples are found unfit for drinking, the reasons for contamination are required to be investigated, and the zonal maintenance staff is required to attend to it immediately.

In this regard, the audit observed the following shortcomings:

- (i) Year-wise details of the samples tested and found adverse or below the required standards during the period 2018-19 to 2021-22 are given in **Table 3.6**.

<sup>4</sup> Of 20 per cent.

**Table 3.6: Increasing rate of failure of water samples in quality testing**

Year	No. of samples collected	Samples were found adverse or below BIS 10500 standard			
		Physical		Chemical	
		No. of Samples failed	per cent of samples failed	No. of Samples failed	per cent of samples failed
2018-19	187982	1517	0.81	1559	0.83
2019-20	200680	2911	1.45	2935	1.46
2020-21	210546	3144	1.49	3189	1.51
2021-22	179946	3138	1.74	3166	1.76

Source: Data provided by DJB

As per ‘Handbook of Service Level Benchmarking’ by Ministry of Urban Development, GoI, benchmark for ‘Quality of water supplied’ is 100 *per cent*. During the period 2018-19 to 2021-22, cases of samples failed in ‘physical quality tests’ out of the total sample collected more than doubled and increased from 0.81 *per cent* to 1.74 *per cent* of the total samples collected. Similarly, samples that failed ‘chemical quality tests’ also doubled from 0.83 *per cent* to 1.76 *per cent*. This shows a deteriorating trend in the quality of water being supplied to residents of Delhi by DJB.

(ii) Out of 12 ACE (M), data of only two were provided. Thus Audit was unable to make a disaggregated analysis of water quality across localities in Delhi.

(iii) Test check of 27 water quality reports at the end point of water supply i.e., at the consumer level, revealed that in 26 cases, only three parameters<sup>5</sup> out of a total of 46 prescribed by IS 10500:2012 were tested by DJB, whereas in one case, 15 parameters were tested (**Annexure 3.2**).

(iv) DJB also draws raw water from borewells, which, after treatment, is supplied to the consumers. It was observed from the replies provided by DJB to audit that only four out of 46 parameters as prescribed by IS 10500:2012 were tested by the laboratories (**Annexure 3.2**) for borewell water.

As seen from the above, tests related to critical parameters viz “toxic substances”<sup>6</sup> “radioactive substances”, “biological tests”, and “virological tests” were not conducted by DJB. Tests for the presence of heavy metals like arsenic, copper, lead, etc. in the water were also not conducted by DJB. It is pertinent to mention here that the presence of radioactive substances and heavy metals in drinking water can be fatal as these substances may cause damage to the liver, kidney, and intestine, and also cause anemia and cancer in humans. Thus, not conducting the above mentioned tests and monitoring water quality for health-critical parameters exposes the residents of Delhi to serious illnesses and health problems.

<sup>5</sup> Residual Chlorine, Total Coliform, E. Coli.

<sup>6</sup> Including pesticides.

The matter was referred to the Government in July 2023, reply was awaited (April 2025). During the Exit Conference, DJB intimated that the Wazirabad lab has been upgraded and that instructions would be issued to all labs to test all the required parameters.

### **3.5 Undue delay in executing works relating to complaints of water contamination**

The Executive Engineer of the division concerned has to take corrective measures on the complaints regarding contaminated water received from residents to prevent supply of contaminated water. Test check of files/records at selected divisions revealed that there were significant delays between the date of receipt of the complaint and to the replacement of the damaged water line (causing supply of contaminated water). The delays in attending to the complaints ranged from 154 days (5 months) to 2,152 days (6 years). Supply of contaminated water to the residents in this interregnum could not be ruled out. Further, delays in attending the complaints indicates that DJB has not put in place a proper responsive grievance redressal mechanism for the complaints related to contaminated water.

The matter was referred to the Government in July 2023, reply was awaited (April 2025). During the Exit Conference, DJB assured that necessary steps will be taken to avoid such delay and instructions will be issued.

### **3.6 Absence of GPS trackers in departmental and hired tankers**

During emergency/short supply of water/repair and maintenance work, water is supplied by DJB through tankers (departmental or hired) to the residents. To ensure accurate and timely delivery at consumer’s end, DJB had initiated (June 2015) a system of installing Global Positioning System (GPS) trackers in such water tankers.

The analysis of around 143 departmental tankers and around 335 hired tankers of seven ACE(M)s<sup>7</sup> and CE(W) Pr-I revealed the following:

- (i) No GPS tracker was installed in the departmental tankers during the period 2017-18 to 2021-22.
- (ii) The percentage of hired tankers in which GPS was installed during the review period ranged between 21 *per cent* to 38 *per cent* only.
- (iii) Analysis of ACE-wise data revealed that in four ACEs(M) viz. (ACE(M)-2, ACE(M)-3, ACE(M)-7 and ACE(M)-10), no GPS was installed in the hired tankers either.

Thus, the very purpose of fitting GPS trackers in both categories of tankers was defeated. In the absence of GPS monitoring in the majority of tankers, the risk of theft, pilferage, and illegal diversion of water is high.

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<sup>7</sup> ACE(M)-4, ACE(M)-5, ACE(M)-9 and ACE (11)- provided two different sets of data which varied from each other, these were excluded from analysis.

The matter was referred to the Government in July 2023, reply was awaited (April 2025). During the Exit Conference, DJB stated that GPS trackers have been installed in all the water tankers. However, no document in support of the assertion was provided to Audit.

### 3.7 Shortcomings in the management of Water ATMs

To improve potable water availability in JJ clusters and areas not connected with a piped network, DJB in the year 2012-13 introduced RO-based decentralized water dispensing machines (Water ATM). Such ATMs were to be entirely managed by private operators who were authorized to extract groundwater for this purpose. The operators recovered their cost by collecting a user fee (as of December 2022, ₹ 2 to ₹ 6 per 20 litres). During the year 2021-22, it was noted that 71 water ATMs were functioning in Delhi.

(i) Details of the quantity of water supplied through these ATMs were not furnished to Audit. In the absence of the details, Audit could not ascertain whether DJB had regulated or monitored the extraction of groundwater for supply through these ATMs, which could have helped DJB in assessing the requirement of water in those areas.

(ii) Data on water quality of only six out of seventy-one Water ATMs was provided by DJB (though complete test reports were not provided), due to which compliance to IS 10500:2012 standards for water quality could not be ascertained.

The matter was referred to the Government in July 2023, reply was awaited (April 2025).

***Recommendation 7: Government should ensure installation, proper functioning, and daily monitoring of GPS trackers in all categories of water tankers and monitor and supervise the quantity and quality of water supplied through Water ATMs.***