Name of City: DHULE

WATER AUDIT REPORT

2015 - 2016

Name: Mr. Anil.Y.Pagar

Designation: Executive Engineer (Water Supply)/ City Engineer

Sign & Seal:

TABLE OF CONTENTS

Conversions Commonly Used in Water Audit

1 m3 = 1000 ltrs.
1 unit = 1000 ltrs.
1 ML = 1000 units / 1000 m3
1 MM3 = 1000 ML
1 MM3/yr. = 2.74 MLD
1 cusec = 2.446 MLD

1.1 PRESENT BILLING SYSTEM

DMC is a sole possessor of its water supply scheme and manages its own water supply and distribution, so also the billing system. Billing system is outsourced and is carried out quarterly for residential consumers and monthly for commercial consumers. Method of billing is as per metered consumption for all categories of consumers, such as domestic, non-domestic. The number of consumers are listed below.

Sr. No.	Particular	Connection count
1	Number of registered Individual metered consumers	0
2	Number of registered Bulk (more than one flat count) metered consumers	0
3	Number of registered commercial consumers	70
4	Number of registered public consumers	0
5	Number of slum connections	4079
6	Number of non-slum registered Unmetered consumers	36629

2. WATER AUDIT METHODOLOGY

2.1 GENERALMETHODOLOGY

Water Audit methodology adopted is described as below:
The audit strategy has to be applied to all the components of the existing water supply system progressively so that entire system from WTP to consumers could be covered. It is advisable to divide area into two parts viz. supply side & demand side. The **supply side** essentially consists of treated water transmission and ESR. It can be easily seen that these components can be tackled efficiently, effectively and speedily due to better access. The other part i.e. **Demand side** essentially consists of the distribution network, connections, metering etc which is a voluminous work as compared with that of supply side. The methodology and various tasks of this strategy to be covered are listed below:

2.1.1 SUPPLY SIDE:

- Identify all the system components from WTP to reservoirs on site and update the maps / information available if required.
- Obtain the log book data of treated water supply in order to assess the average daily pumping need over the period of one year.
- Obtain the details pertaining to capacities of sumps and storage reservoirs, condition of existing measuring system such as flow meter and / or level indicator, their inflow & supply hours.
- Carry out flow measurements simultaneously to the extent possible in order to assess the quantum of water released in specified period, preferably a day.
- Assess the difference in the measurements to estimate the losses

2.1.2 DEMAND SIDE:

- Obtaining the list of water supply connections (domestic & non-domestic) in the distribution system. As most of the consumers are metered and billing is done by photo reading, all the billing data is taken for reference.
- Measure the supply of water from the storage reservoirs which is let into the distribution system in order to assess the quantum of water supplied in the whole city.
- Fill up the audit sheet

3. CALCULATION OF NON REVENUE WATER

3.1 TASK-1: SYSTEM INPUT VOLUME:-

3.1.1 WATER INPUT OR PURCHASE FROM IRRIGATION DEPARTMENT: -

Is the volume of water input to a transmission system or purchased from Irrigation Department (ID).

3.1.2 RAW WATER INTAKE: -

Raw water charges paid to Irrigation Department.

A		B	C	D	E
System Input Volume					
1	Identify and map the sources.				
2	Measure the water from each raw source (Phase – I ,II& III).	**58 MLD**			
3	Adjust the figures for total supply.				

System Input Vol. = 58 MLD.

3.2 TASK-2: BILLED METERED CONSUMPTION & BILLED UN-METERED CONSUMPTION:-

Average quantity is taken into account for Billing as per consumer data.

A	B	C	D	E
System Input Volume		Billed Authorized Consumption	**Billed Metered Consumption** (Including water exported)	**Revenue Water** (Total billed qty.)
			0	32.19 MLD
			Billed Un-metered Consumption	

58		**32.19**	**32.19**	**32.19**

- **Billed Metered Consumption** (including water exported)
- **Billed Un-metered* Consumption**: Ref. Diagram showing Total Water losses observed, For Total Extrapolated Billed Unmetered consumption.

  i.e. **32.19 MLD for 40778 Connections**

3.3 TASK-3: CALCULATE THE VOLUME OF NON-REVENUE:-

Non-Revenue Water = System Input Volume (Col-A) – Revenue Water (Col-E)

A	B	C	D	E
System Input Volume (mld)		Billed Authorized Consumption (mld)	Billed Metered Consumption (Including water exported)	Revenue Water (mld)
			Billed Un-metered Consumption	**32.19**
58				

Non-Revenue Water = System Input Vol (Col.-A) – Revenue Water (Col-E).

Non-Revenue Water =Col. A – Col. E

= 58 – 32.19 =25.81 MLD

3.4 TASK-4: CALCULATE THE UNBILLED AUTHORIZED CONSUMPTION (METERED & UNMETERED)

i) Public stand post water supply

ii) Tanker water supply

iii) Corporation offices, Schools, Hospitals.

iv) Public Parks & Gardens (old).

v) Public Urinals.

vi) Un-metered unbilled connections.

Un Billed Metered Consumption –connections are flat water tariff, based on tapping size & type of consumer is charged by corporation.

Un Billed Un-metered* Consumption Ref. Diagram showing Total Water losses observed, for Total Extrapolated un- Billed Unmetered consumption. I.e. Consumption from free connections & PSP as per consumer survey)

3.5 TASK-5: CALCULATE AUTHORIZED CONSUMPTION:-

Authorized Consumption = Billed Authorized Consumption (Top of Col b) + Unbilled Authorized Consumption

<table>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td rowspan="5">System Input Volume

58 MLD</td><td rowspan="2">Authorized Consumption (Billed Authorized Consumption + Unbilled Authorized Consumption)
32.19 MLD</td><td>Billed Authorized Consumption</td><td>Billed Metered Consumption (Including water exported)</td><td>Revenue Water</td></tr>
<tr><td>32.19 MLD</td><td>Billed Un-metered Consumption</td><td>32.19 MLD</td></tr>
<tr><td>Water Losses</td><td rowspan="3">Unbilled Authorized Consumption

25.81 MLD</td><td>Unbilled Metered Consumption</td><td rowspan="3">Non-Revenue Water (System Input volume – Revenue Water)</td></tr>
<tr><td></td><td>Unbilled Un-metered Consumption</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td rowspan="2">(System Input Volume – Authorized Consumption)</td><td></td><td></td><td>25.81 MLD</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

- Un-Billed Authorized Consumption = 25.81 ML (*Ref. calculation at Task No. 4)*
- Billed Authorized Consumption = 32.19 MLD (*Ref. calculation at Task 2)*

Total = 58 MLD

3.6 TASK-6 CALCULATE WATER LOSSES

A	B	C	D	E

<table>
<tr><td rowspan="3">System Input Volume

58 MLD</td><td rowspan="2">Authorized Consumption (Billed Authorized Consumption + Unbilled Authorized Consumption)
58 MLD</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption (Including water exported)</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Un-metered Consumption</td></tr>
<tr><td></td><td>Unbilled Authorized Consumption
__</td><td>Unbilled Metered Consumption
Unbilled Un-metered Consumption
__</td><td>Non-Revenue Water (System Input volume – Revenue Water)</td></tr>
<tr><td></td><td>Water Losses (System Input Volume – Authorized Consumption)
25.81 MLD</td><td></td><td></td><td></td></tr>
</table>

Water Losses= System Input Volume - Authorized Consumption (Col.B)

= Col. A. – Col. B

= **58 – 32.19 =25.81 MLD**

3.7 TASK-7 CALCULATE THE APPARENT LOSSES:-

Apparent Losses = Un-authorized Consumption + Metering Inaccuracies

3.7.1 UN-AUTHORIZED CONSUMPTION:-

- Estimated illegal consumers
- Estimated water consumption
- The cost of water consumption

3.7.2 METERING INACCURACIES:-

- Raw Water Measurement Losses

- Losses at Pump House
- Measurement Losses in Distribution System

<table>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td rowspan="2">System Input Volume In</td><td rowspan="6">Authorized Consumption (Billed Authorized Consumption + Unbilled Authorized Consumption)

32.19.MLD</td><td rowspan="2">Billed Authorized Consumption
32.19.MLD</td><td>Billed Metered Consumption (Including water exported)
0</td><td rowspan="2">Revenue Water Mld

32.19 MLD</td></tr>
<tr><td rowspan="2">58 MLD</td><td>Billed Un-metered Consumption
25.81
MLD</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption
00</td><td rowspan="3">Non-Revenue Water (System Input volume – Revenue Water) Mld

25.81 MLD</td></tr>
<tr><td>25.81 MLD</td><td>Unbilled Un-metered Consumption
25.81 MLD</td></tr>
<tr><td></td><td rowspan="4">Water Losses (System Input Volume – Authorized Consumption)

25.81 MLD</td><td rowspan="4">Apparent Losses
In mld</td><td>Un-authorized Consumption</td></tr>
<tr><td></td><td>Mld</td></tr>
<tr><td></td><td>Metering Inaccuracies (mld)</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

3.8 TASK-8 CALCULATE REAL LOSSES:-

Real Losses = Water losses (Col.-B) – Apparent losses (Col.-C)

*Unidentified water losses included in Real losses.

<table>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td rowspan="6">System Input Volume

58 MLD</td><td rowspan="3">Authorized Consumption (Billed Authorized Consumption + Unbilled Authorized Consumption)
32.19 MLD</td><td rowspan="2">Billed Authorized Consumption
32.19 MLD</td><td>Billed Metered Consumption (Including water exported)
0</td><td>Revenue Water Mld</td></tr>
<tr><td>Billed Un-metered Consumption
32.19 MLD</td><td>32.19MLD</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption
0 MLD</td><td>Unbilled Metered Consumption
0.00</td><td rowspan="4">Non-Revenue Water (System Input volume – Revenue Water)

25.81 MLD</td></tr>
<tr><td>Unbilled Un-metered Consumption
0 MLD</td></tr>
<tr><td rowspan="3">Water Losses (System Input Volume – Authorized Consumption)

25.81 MLD</td><td rowspan="2">Apparent Losses

25.81MLD</td><td>Un-authorized Consumption
25.81MLD</td></tr>
<tr><td>Metering Inaccuracies Mld</td></tr>
<tr><td>Real Losses (Water Losses – Apparent Losses)25.81MLD</td><td></td></tr>
<tr><td colspan="4">*Unidentified Water Losses</td></tr>
</table>

Real Losses = Water losses (Col.-B) – Apparent losses (Col.-C)

= 58 – 32.19

= 25.81 MLD

3.9 TASK-9 ASSESSMENT OF REAL LOSSES:-

There are following sources of real losses in water system.

i. Leaks at raw water transmission

ii. Evaporation losses

iii. Water treatment losses
iv. Leaks / seepage of reservoirs
v. Overflows of reservoirs
vi. Leaks of distribution mains
vii. Leakages from valves & air valves
viii. Leakages from service connections up to meter
ix. Leakages in consumer premises after the meter (not in scope of water audit)

Measuring & estimating losses from discovered leaks the following methods have been adapted for measuring & estimating losses for discovered leaks are.

i. Bucket and stop watch methods
ii. Portable Ultrasonic Flow Meter
iii. Volumetric measurement
iv. Measurements by partially filled pipe, V-notch etc

A	B	C	D	E
System Input Volume (ML)	Authorized Consumption (ML)	Billed Authorized Consumption (ML)	Billed Metered Consumption (including water exported) (ML)	Revenue Water (ML)
	32.19	32.19	0	32.19
=	32.19	32.19	0%	50%
58 MLD	55.5%	55.5%	Billed Un-metered* Consumption	
			8.55	
		Unbilled Authorized Consumption (ML)	Unbilled Metered Consumption(ML)	Non-Revenue
		0	0	25.81
				44.5%
	Water Losses (ML)	Apparent Losses (ML)	Un-authorized Consumption (ML)	
	25.81	25.81	25.81	
	44.5%			
		Real Losses (ML)	Leakage on RW Transmission (ML)+WTP Losses (ML)	
		25.81	10.32%	
			15.49%	
		44.5%	Leakage on PW Transmission (ML)	
			+	
			Leakage on Service Connections up to point of Customer metering (ML)	
			10.32+15.49	
			=25.81%	

ANNEXURES

1. BASIC DATA

Assesment of NRW (Year 2015-16)											
Sr. No.	Particular	unit	A	B	C	D	E	F	Total	Billed water in ML in 2015-16	Billed water in MLD in 2015-16
1	Number of registered Individual metered consumers as on 31/03/2016	Nos.	19027	16884	15265	22690	23139	20062	117067	N. A.	
2	Number of registered Bulk (more than one flat count) metered consumers as on 31/03/2016		1481	2336	1209	2160	1511	1749	10446		
3	Number of registered commercial consumers as on 31/03/2016		676	585	430	555	1151	523	3920		
4	Number of registered public consumers as on 31/03/2016		38	4	2	11	4	24	83		
5	Number of slum connections		2376	461	2799	1158	60	3	6857		
6	Number of non-slum registered Unmetered consumers as on 31/03/2016		110	347	483	1045	698	179	2862		
7	Total Billed volume of individual consumers as per billing data for 2015-16		7479465	5673451	4869925	7488603	7305463	7085448	39902355	39902.355	109.321521
8	Total Billed volume of Bulk consumers as per billing data for 2015-16		5971245	6947859	3852584	6566121	4315805	6631377	34284991	34284.991	93.9314822
9	Total Billed volume of commercial consumers as per billing data for 2015-16		352835	230847	231647	167990	470600	136797	1590716	1590.716	4.35812603
10	Total Billed volume of public consumers as per billing data for 2015-16		70015	7805	4330	41990	682	67204	192026	192.026	0.52609863
11	Average volume of slum consumers on assumption for 2015-16										
12	Average volume of unmetered & non-functional metered consumers on assumption for 2015-16										8.55
13	Average volume of municipal buildings, hospitals on assumption for 2015-16										
14	Average volume of unbilled consumers on assumption for 2015-16										
15	Details of water purchased from other authorities like MIDC in the year 2015-16										
16	Collection against Billed Volume (Rs. In crores)		9.92	5.56	4.64	5.73	6.1	5.85	34.83		
17	Infrastructure + Development Charges										
18	Net Revenue Collection										
19	Total Production of water (system input)								432.45		
20	Total Revenue Water								216.35		
21	NRW								216.1		
22	Average Tariff								49.97		