

## **Terms of Reference on Water Audit in Selected ULBs**

The Director of Municipal Administration, Chennai-5, now invited Consultancy firms and Individual Consultant to register their interest in participating in the assignment for conducting water audit in Coimbatore, Madurai, Vellore Corporations and Nagercoil, Dindigul, Udthagamandalam, Namakkal, Mettur, Pudukottai, Cuddalore, Aruppukottai and Krishnagiri municipalities after conducting training for ULB staff by sending the following information.

a.	Name, address and fax number of Consultancy firm
b.	Ownership and Organizational Structure of the firm
c.	Financial Statement for the last three years
d.	Name and short CVs of Key Staff
e.	Details of Experience in Similar nature of the assignment.

Expression of Interest (5 copies) must be submitted for the above assignment during office hours on or before **18.01.2011** to the above address. Documents received thereafter will not be accepted.

On the basis of obtained information from interested Consultants, the Director of Municipal Administration will prepare and short-list of Six Consultants who will be invited to submit their proposals.

Interested parties may obtain further information about the Consultancy assignment from the following officers at the address mentioned below:

**Contact Person:**

Thiru. R. Lingasamy, Procurement & Administrative Officer (i/c)  
Mobile No: 94443 43063

Thiru. G.Manian, Urban Development Specialist, TNUDP-III at telephone no:  
044-28550200. Mobile No: 98845 64311

Contact hours: 10:00 am to 5.45pm

Director of Municipal Administration

## **Terms of Reference:**

### **Water Audit in Selected ULBs**

#### **1. Background**

The Water Supply Schemes are being implemented by the ULBs and State Nodal Agencies such as Tamil Nadu Water Supply & Drainage (TWAD) Board and Chennai Metropolitan Water Supply & Sewerage (CMWSS) Board and maintained by the ULBS in the State. These ULBs pump several million liters of water from various sources daily through heavy duty pumps, transmit and distribute water to the public after giving treatment. There is mismatch between the quantity of water pumped and the quantity of water received for distribution, which is due to Unaccounted for Water (UFW) because of illicit tapping, transmission loss, leakage etc., in the water supply system. This loss also called as 'Non Revenue Water' (NRW) can be avoided by introducing system improvements. In the first instance, the Unaccounted for Water (UFW) has to be quantified, which is a top-down approach and then measures have to be taken to reduce the same, which is a bottom up approach. This leads to the necessity for taking up a Water Audit study in the Water Supply system of ULBs. The additional revenue generation because of the water audit will help the ULBs for reinvestment on the operation and maintenance (O&M) and ensure sustainability of the water works.

In the recent years, the energy consumption charge has increased in the ULBs and nearly 70% of the O&M charges goes towards the electricity charge. A field assessment in select ULBs will throw light on the pattern of usage of electricity. This will help working towards energy saving methods. Undertaking Water Audit in City Municipal Corporations

and Municipalities can help the ULBs to focus their effort by identifying cost effective methods to improve efficiency.

## **Water Audit**

### **2. Objectives of Water Audit**

The objective of the study is to conduct water audit to assess (i) water produced (ii) water used (iii) losses both physical and non-physical, and (iv) to identify and prioritize areas which needs immediate attention for control which is for the benefit of the ULBs. Implementation of power saving methods to reduce municipal expenditure and to achieve savings in consumption of electric power in Water Supply System. This should also enable a reasonable investment plan for the repair, replacement, strengthening of the water supply system in a few selected Corporations and Municipalities on a pilot basis, after imparting necessary training and awareness among the municipal officials concerned.

### **3. Water Audit Study:**

To take up Water Audit in ULBs, the Bidder /Consultant will take up a sequence of steps as mentioned in the Central Public Health Engineering & Environmental Organization (CPHEEO) Manual on Operation and Maintenance of Water Supply System.

The major activity during the overall water audit will be bulk meter installation at those points on the distribution network, where water enters the system. It is expected that bulk meters will be required at (i) All major system supply points (ii) All tube wells which supply the system directly, and (iii) Major transfer mains which are expressly required for audit and (iv) At distribution centers, the most appropriate meter position is on the outlet pipe from the service reservoir. Installation of a meter at this point will allow measurement of flows into the system not only if supplies are coming from the service reservoir but also if they are being pumped directly from the clear water reservoir (CWR).

Water Audit of a Distribution System consists of:

- i) Monitoring of flow of water from the distribution point into the distribution system (WMA).
- ii) Consumer sampling.
- iii) Estimating metered use by consumers.
- iv) Estimating losses in the appurtenances and distribution pipe line network including consumer service lines

**4. Detailed Tasks to be Performed:**

The tasks to be carried out by the Bidder/ Consultant are as follows:

i)	Study the existing system from the available records and field verification of the various features <i>viz</i> Raw water transmission, Reservoirs, Treatment plant, Clear water transmission system, Inter zonal transmission system and Tube wells.
ii)	Collection of data on the system installations (reservoirs, treatment plant), O&M practices, breakdown history, efficiency, system leakage and losses, quantity of water handled and electrical data (contract demand, hours of operation, peak loads, supply availability, tariff level, annual consumption, power costs etc
iii)	Take a reconnaissance along the system facilities and note visible leakages in transmission mains, feeder mains, reservoirs and distribution system and indicate areas where pit taps are existing.
iv)	Study of the existing water supply network, assess the potential for savings in water.
v)	Study the water supply system of the town from various sources, all the transmission and supply mains with a view to minimize O&M cost, and to create database on water supply system with ID Network with proper zoning.

vi)	Obtain data on the scheme design and note the total design capacity of system, and assess the quantity of water supplied from TWAD/ Source; if no bulk flow meter is installed, Use ultrasonic portable flow meter to assess the same.
vii)	Calculate transmission losses; Analyze the quantum of Unaccounted for Water (physical and commercial losses) and suggest measures to curtail / minimize it.
viii)	Assess the defects in the existing system by measuring the flow and pressure at strategic points in all zones of the towns and comparing with the output of the water supply network.
ix)	Obtain a system map of feeder mains for feeding the OHSRs of distribution system from Entry point of ULB sumps, and <ul style="list-style-type: none"> <li>• Assess the quantity of water supplied from the receiving sump of the OHSRs.</li> <li>• If no bulk flow meters are installed at inlet to OHSR, Use ultrasonic portable flow meter to assess the same, Calculate the feeder main losses.</li> </ul>
x)	Assess quantity of water distributed and received by the consumers: This requires: <ul style="list-style-type: none"> <li>• Select one or two zones where leakages or negative pressures/pit taps are prevalent,</li> <li>• Select a line which feeds approximately 100 households in each selected zone for detailed study</li> <li>• Fix isolation valves and bulk flow meters at entry and exit of the study area</li> <li>• Fix Consumer ISO/ EEC meters to the selected households along with a stop cock at entry to house</li> <li>• Note the quantity of water entering and exiting the distribution system and also the water consumed by households as shown by the meters.</li> </ul>

xi)	Calculate physical leakage losses and non-physical/commercial losses in distribution system and the revenue loss due to faulty meters or under billed consumers.
xii)	<p>Select a few Public taps, fix meter and assess the quantity supplied which is not billed for and calculate revenue loss.</p> <p>Review the above data and prioritize the areas as where leak detection is required, where pipes are to be replaced and where close monitoring is required.</p>
xiii)	<p>The Bidder /Consultant will have Equipment required for the water audit study: Portable ultrasonic flow meters, bulk flow meters, consumer meters, isolating sluice valves, and stop cocks.</p> <p>The Bidder /Consultant may verify the equipments available with ULBs for this study and inspect the equipments. The proposal will include only the cost of additional equipment required</p>
xiv)	<p>Leak detection study to be done in selected areas: This involves: Pipe location survey. Measuring flows and pressures; locating leaks and assessment of leaks;</p> <p>Equipment required for Leak Detection Study includes Pipe locators, electronic sounding rods- leak locators, leak noise correlators, water tank and pump for pressurizing, Turbine bulk flow meters. The Consultant/Bidder to inform the methodology proposed to be adopted by them for leak detection and the equipments to be deployed.</p>
xv)	Suggest measures for improvement and equitable distribution of water in the town.
xvi)	Prepare an investment proposal for improvement measures to the operation and maintenance of water supply system
	Carry out an Audit of the existing power requirement of the ULBs and usage, and accurate assessment of power used by the ULBs in Water Supply System.

xvii)	Review the pumping schedule and quantify energy consumption at each stage of water supply, and review the merits of over head storage facility/direct pumping in the network. Establish the current and projected electrical power load and energy consumption as well as demand in water supply system.
xviii)	Determine the operating efficiency of each pumping station. This shall be based on the on-site tests conducted, and by establishing pump characteristic curve.
xix)	Establish energy consumed / 1000 liters of water pumped. Suggest options for improving the efficiency and reducing the energy consumption of the pumps
xx)	Justify the proposals with suitable cost-benefit analysis and arrive at a cost effective strategy with a target of (a) Reduction in water losses (b) Financial Improvement (c) Increased knowledge of distribution system (d) More efficient use of existing supply (e) Safe guarding public health & property (f) Reduced legal liability
xxi)	Analyze the impact of the investment proposed on the finance of the Corporation/ Municipality, and Suggest measures to sustain the investment.
xxii)	Preparation of DPR and Cost Estimates using the latest schedule of rates of TWAD/PWD for the above stated tasks.
xxiii)	Conduct a training workshop on Water Audit to the municipal officials for imparting knowledge for (i) monitoring leakage level (ii) locations of leakage using equipments such as noise correlators, amplifiers and testing sticks (iii) leak detection methods possible under defective conductions, for better performance of the water supply system

## **8. Data inputs and Services from the Client/ ULBs**

The Client /ULBs concerned will assist in the study and coordinate with the agencies like TWAD Board and CMWSSB. They shall make available their senior officers for consultation purposes and furnish the available relevant data and documentation, maps for consultant's reference and study.

## **9. Study Area**

The Water Audit will be taken up in Coimbatore, Madurai & Vellore Corporations, and Nagercoil, Dindigal, Udthagamandalam, Namakkal, Mettur, Pudukkottai, Cuddlore, Aruppukottai and Krishnagiri Municipalities.

## **10. Outputs, Reporting and Schedule for Completion of the Assignment:**

<b>Outputs</b>	<b>Time from Start</b>	<b>Payments (% to Total)</b>
<b><u>Inception Report (20 copies)</u></b>  Field Visits & Reconnaissance Survey along the System facility in ULBs - Study of the Existing water supply system - Methodology for performing the Water Audit in the ULBs; Work Plan & Staffing Schedule for completion of the assignment.  Submission of the Inception Report for review of the Review committee.	1month	10%
<b><u>Interim Status Report (20 copies)</u></b>  (i) Study on the System installation and Existing water supply network	3months	40%

<p>(ii) Collection of data on scheme design, system installations (reservoirs, treatment plant), O&amp;M practices, breakdown history, efficiency, system leakage and losses, quantity of water handled and electrical data (contract demand, hours of operation, peak loads, supply availability, tariff level, annual consumption, power costs etc) Creation of data base on water supply system with ID Network with zoning</p>		
<p>iii) Assess the quantity of the water distributed and the quantity received by the consumer</p>		
<p>iv) Study on the water supply system of the town from various sources, all the transmission and supply mains with a view to minimize O&amp;M cost</p> <p>v) Study of the existing water supply network, and assessment of savings in water.</p>		
<p>vi) Assess the defects in the existing system by measuring the flow and pressure at strategic points in all zones of the towns and comparing with the output of the water supply network.</p>		
<p>vii) Leak detection study for assessment of the quantum of Unaccounted for Water (physical and commercial losses)</p>		
<p>viii) Calculate transmission losses; Analyze the quantum of Unaccounted for Water (physical and commercial losses) and suggest measures to curtail / minimize it.</p>		
<p>ix) Calculate physical leakage losses and non-physical/commercial losses in distribution system and the revenue loss due to faulty meters or under billed consumers.</p>		

<p>x) Prioritize areas as where leak detection is required, where pipes are to be replaced and where close monitoring is required.</p>		
<p>xi) Study of the Existing Power utilization in water supply system; Make Accurate assessment of power uses in water supply system</p> <p>xii) Audit of the existing power requirements of the Water Supply system &amp; Assessment of the potential for energy saving;</p> <p>xiii) Review of the power charges /cost for the power supply, and the power charges met by the ULBs with reference to Water Supply System.</p> <p>xiv) Determination of the operating efficiency of each pumping station. Establishment of the energy consumed per 1000 liters of water pumped. Suggest options for improving the efficiency and reducing the energy consumption of the pumps. Submission of the Intermediate Status Report for the review of Review committee.</p>		
<p><b>Draft Final Report ( 20 copies)</b></p> <p>i) Prepare an investment proposal for improvement measures to the operation and maintenance of water supply system</p> <p>ii) Justify the proposal with cost benefit analysis and suggestion for cost effective strategy</p> <p>iii) Suggest measures to sustain the investment.</p>	<p>5Months</p>	<p>30%</p>
<p>iv) Suggestions for improvement to the O&amp;M of the Electrical system in the ULBs, and related institutional issues with reference to Water Supply System.</p>		

<p>v) Analysis of the impact of the investment proposed on the finance of the Corporation/ Municipality in water supply system.</p> <p>Submission of the Draft Final Report for review of the Review committee.</p>		
<p><b><u>Final Report &amp; Conducting Workshop (30 copies)</u></b></p> <p>i) Preparation of DPR and Cost Estimates using the latest schedule of rates of TWAD/PWD for the above stated tasks.</p> <p>ii) Conduct a training workshop on Water Audit for ULB Officers and staff. Submission of the Final Report for review of the Review committee.</p>	6 Months	20%

## **11. Composition of the Review Committee**

The Review committee includes:

- i. The Director of Municipal Administration or his nominee
- ii. Managing Director & Chief Executive Officer, TNUIFSL or his nominee
- iii. The Joint Commissioner of Municipal Administration.
- iv. The Chief Engineer, O/o the Director of Municipal Administration
- v. City Engineer/ Municipal Engineer of the concerned ULBs
- vi. Engineering Director, TWAD Board/ Chennai Metropolitan Water Supply and Sewerage Board or his Nominee (External Member)
- vii. Chief Engineer (Distribution), TNEB or his Nominee (External Member)

**12. Skill Requirement:** The following Key Professionals are to be engaged by the Consultant along with required support staff. The C.V. of the following professional will be reviewed for technical evaluation.

<b>Specialization</b>	<b>Requirement</b>
Urban Infrastructure Specialist /Team leader	Master's Degree in Hydraulics Engineering or equivalent qualification with around 10 years experience in Water Audit & Energy Audit or similar studies
Energy Management Specialist	Masters degree in Energy Management or equivalent qualification with around 7 years experience in Energy management/Audits
Urban Infrastructure Engineer	Master's Degree in Urban Engineering with around 5 years experience in Water Audit & Energy Audit or similar studies
Electrical/ Mechanical Engineer	Bachelor's Degree in Electrical/Mechanical Engineering with around 5 years experience in Water Audit & Energy Audit or similar studies
Energy Management Engineer	Degree in Energy Management or equivalent qualification with around 5 years experience in Energy management/Audits
Urban Finance and Management Specialist	Master in Financial Management / CA or equivalent qualification with around 5 years experience in Urban Financing.