

Water Audit for Water Distribution Networks in Educational Campus

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Abstract:-In an educational institute's water is used for laboratory, bathroom, urinals, hostel, canteen, etc. This should need to measure balance of input water to output water. This water proportion is low at the end of the water distribution networks because of the leakages, overflow, and losses through valve. So it is need to water audit of this entire water distribution system. This should save the money to unaccounted water flow and this conserve water used into lesser extent period. An educational institutes need to care about water distribution from start to end. And need to attention at minimum water losses through distribution network. The study indicates that the unaccounted for water and leaks are responsible for the wastage of water. Preventive measures should be taken for reducing the total UFW. The distribution system should be checked for integrity and leaks from time to time to maintain efficiency of the system and to reduce water losses.

Keywords- water audit, water loss, leakages

1. INTRODUCTION

Water is life for all animated animal which live on the earth. As we know the rapid growth of humiliation and industrialisation, there is scarce of water on the earth. So it is need to be conserving the water for future and safe humiliation. And also need to measure the quantity of water which is present on the surface of the earth, this is known as water audit. The water audit displays how quantity of water flows into and out of the distribution system and to the customer. Water auditing is a systematic & scientific examination of water accounts of the projects. It provides a rational, scientific framework that categorizes. The dominant ideology of fresh water as an abundant and unlimited resource continues to persist despite the common global knowledge that only less than one per cent of the Earth's fresh water source is readily available for human use.

In India most of the institute present to give the education for student. This institute are having hostels, canteens, department, laboratory, urinals, etc. to use the water, but most of time due to leakage or mind set of human the mostly water is waste. So it is need to save the water for future use of water.

Due to scarcity of water in summer it is need to save and conserve the water in monsoon season. So some intervals of time update the quantity and quality of water use. And take the major action to save the water. The best option to measure use and loss of water is take an audit of water. Water audit for distribution networks in college campus. A water audit determines the amount of water lost

from a water supply system and the cost of this loss to the utility.

There is a need for water conservation, not only to restore the fast deteriorating eco-system of the country but also to meet the inevitable emergency of shortage even for drinking and domestic water in near future. Water conservation has not been implemented fully in our society. Given low economic consequences from water use, water efficient strategies of education, public awareness, and conservation techniques and technologies need to be addressed to counteract this non-conservable behaviour.

2. PROCEDURE FOR COLLECTION OF DATA

To perform the water audit there is some questionnaires' important to know the present condition of water distribution system. This is basic tool to measure the water and to know the distribution system. For apply this auditing there are some steps are executed in forward direction as below.

2.1. Set Study Period:

A study period should be set to allow an evaluation of the complete water system. One year is recommended because it includes all seasons and gives enough time to eliminate the effect of meter reading lag. Shorter periods might not give a complete picture of the water system, and longer periods can be difficult to manage.

2.2. Develop a worksheet:

A worksheet, similar to an accounting spreadsheet, should be developed that will make

the computations clear and simple and allow the utility to balance water produced with water used. As well as balancing water in and out of the distribution system, the worksheet should list and account for various water usages.

- Preliminary survey
 - Questionnaire's
 - Study area
 - Water supply
 - Distribution system
 - Transmission of water
- Water consumption
 - Metering to water supply
 - Identify the leakage and losses
 - Quantity of water
 - Storage of water tank
 - Total consumption of water
- Water balance
 - Measure system input
 - Apparent losses
 - Real losses
 - Revenue water
 - Non-revenue water
- Final report
 - Analysis
 - Evaluation
 - Updatation
 - Submission

3. QUESTIONNAIRES' FOR WATER AUDITING

3.1 Base line Information

- Name of the Department
- Month and Year

3.2 Water user profile

- Water users include students, staff, visitors etc.
- Total number of water users
 - Number of employee
 - Number of students
 - Rain water system available – Yes/No
 - Is rain water harvesting system working? – Yes/ No
 - Pipe material
 - Inlet and outlet pipe (in mm)
 - Daily water supply
 - Motor to be used (HP)
 - No of R.O. water bottle

4. METHODOLOGY

In the present investigation Water audit of existing system is carried out from Source to tap in proposed area. The audit conducts start up

discussion with local plant in-charge or staff maintaining the plant and all required pumping station data is collected. After the establishment of the study worksheets measure the water supply of proposed area. The study will be also incorporates the fluctuation in water supply levels in pre-monsoon and post-monsoon seasons.

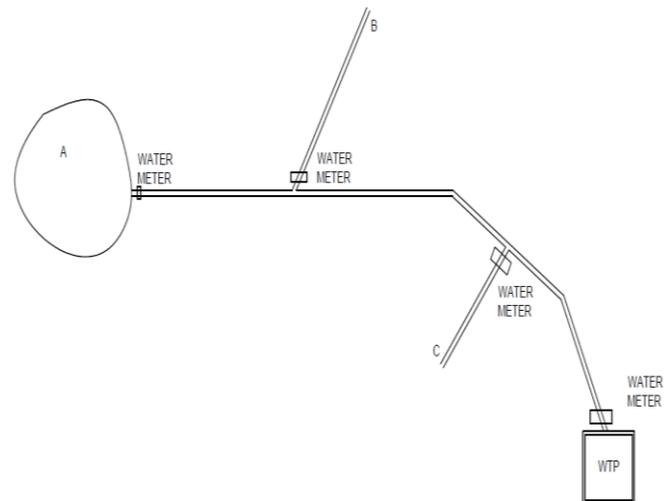


Figure 1: - Water transmission system
A- Source of water B, C- Tap connection

4.1 Assessment of water requirement (Table 2)

- Water storage- calculates the total water storage in entire educational campus as per the capacity and measure the total time to fill the water storage structure. Also at a time of filling the storage tank keep care about precise filling timing. Don't miss any storage tank in distribution system.(Table 1)
- Water losses- in entire distribution system measure the leakage places and calculate the no of leakages. Measure the total water use (daily) in campus. After spotting the leakages measure the rate of discharge (litre/min) and then measure daily loss to whole distribution system (in litre). (Table 2)
- Instrument- To obtain the most accurate results the condition of both the liquid and the pipe must be suitable to allow ultrasound transmission along the predetermined path [9]. It is important that liquid flows uniformly within the length of pipe being monitored, and that the flow profile is not distorted by any upstream or downstream obstructions.
- Leak detection-Leak detection is a survey of the distribution system (including in main pipeline) to identify leak sounds and pinpoint the exact locations of hidden underground leaks.

Details of the storage structures -

Storage tanks	Capacity (Liters)	Number	No. of time filled
Overhead 1			
Overhead 2			
Underground			
Underground			
Total			

Table 1:- Water storage structure

Assessment of water requirement as per following table:-

Sr. No	Site	Total No. of Sources	Measurement of Water Uses (Daily)		
			Rate of Discharge (L/m)	Average Duration of Use (min)	Total Daily Use (L)
1	Bathroom				
2	Toilet				
3	Labs				
4	Other				
Total					

Table 2:- Assessment of water requirement

Measurement of water losses

Sr. No	Site	Total No. of Leakages	Measurement of Water Uses (Daily)		
			Rate of Discharge (L/m)	Daily loss (L)	Total Loss (L)
1	Bathroom				
2	Toilet				
3	Laboratory				
4	Other				
TOTAL					

Table 3:- Calculation of water losses

5. RESULT AND DISCUSSION

Water audits can be designed by reviewing the system records and staff expertise

and using these resources to develop and complete effective worksheets [7]. Distribution system characteristics vary, so each utility will have different challenges in performing the water audit. Each system will need to decide how it can perform the audit accurately with the least cost. A worksheet should be developed, and a study period set. UFW includes leakage, theft by illegal connections, meter under-registration, meter reading errors and malpractice. UFW is often expressed as a percentage of water produced. The water audit of the system is as follows:

UFW has two aspects:

"Physical losses" or water actually lost through leaks. Leaks may stem from poorly constructed plants, reservoirs, and networks, aging systems and house connections, accidents, and poor maintenance. "Administrative losses", or revenue lost through unbilled or under billed consumption.

This can result from administrative failures such as inaccurate or faulty metering, incorrect billing, and theft [1].

Authorized use	Billed authorized use	Billed Metered Consumption	Revenue Water
		Billed Un-metered Consumption	
Unbilled authorized use	Unbilled authorized use	Unbilled Metered Consumption	Non-Revenue Water
		Unbilled Un-metered Consumption	
Water losses	Apparent losses	Un-authorized Consumption	Non-Revenue Water
		Metering Inaccuracies	
	Real losses	Raw Water Transmission Losses	
		WTP Losses	
		Storages Overflow Losses	
		Raw Water	

			Distribution Losses	
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Table 1: water balance sheet [1]

As per the water balance sheet it is find apparent losses and real losses of the water which wasted during the distribution process. The use of modern technic for measuring the water loss should be utilised so as to gain updated records about water loss and further improved the financial loss [12].

6. NEED FOR ATTENTION:

- The water audit has found following errors that water overflows from the storage tank located at roof top gave tremendous amount of loss of water.
- Due to poor habit or misconduct ion while operating taps at wash basin, W.C. etc not close it properly, leaving the taps open leads to wastage of water at most of the department in university campus.
- When the trench digging process accidentally effect leads to damage of pipelines and contribute to leakage and wastage of water, work and time. There is need to generate to make a new revised map so as to locate the distribution pipelines for making it easier for carrying out the future work related to the water pipeline.

REFERENCES

[1] American Water Works Association California-Nevada Section, Water Audit and Leak Detection Guidebook (June 1992).

[2] Amola.Kulkarni, Avinash A. Patil, Balasaheb b. Patil (2014), "Water audit: a case study of water supply scheme of Shrivardhan", Journal of computing technologies (2278 – 3814), vol. 3, issue 6, pp-5-11.

[3] Amol A.Kulkarni, Avinash . Patil, Anil C. Ranveer, Prof. G. K. Deshmukh, (2014), "Leak Detection of Water Supply System by Water Audit– A Case Study of Ahmedpur", international journals of software & Hardware Research in engineering, vol. 2, issue11, pp-10-19.

[4] Biswadip das, Water audit: methodology and solution (2009), pp-42-48.

[5] Central water commission, Evaluation of water utilization directorate general guidelines for water audit & water conservation, December 2005.

[6] Dr.Kartiki S. Naik and Madelyn Glickfeld (2015), Water Distribution System

Efficiency: An Essential or Neglected Part of the Water Conservation Strategy for Los Angeles County Water Retailers?

[7] Mansi Master, Khushbu Gandhi, (2017), "Water audit and inevitability of water meter", International Research Journal of Engineering and Technology, Vol. 04, Issue: 04, Pp-594-598.

[8] Nagpur Municipal Corporation (NMC) (2005): Water sector audit enables efficient use of water and energy resources in Nagpur.

[9] NehaHardikar (2010), water audit and leak detection.

[10] R. A. Ganorkar and Isha.P. Khedikar (2011), "Water audit", International journal of advanced engineering sciences and technologies, vol. No. 8, issue no.1

[11] R.A.Ganorkar, P.I.Rode, S.A Deshmukh, Dr.R.M.Dhoble, (2013), "Water Audit- A Tool for Assessment of Water Losses", International Journal of Computational Engineering Research, Vol. 3 Issue.3, pp-252-256.

[12] Water Audit and Leakage Control, (2005) CPHEEO.

[13] Water Management and Reforms Project, Maharashtra SujalNirmalAbhiyan (MSNA).

[14] Water Audit for Centre for Science and Environment (CSE), Ministry of Urban Development, Government of India.