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"Water Conservation Potential in Institutional Campus"

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Abstract:

The availability of potable water is declining due to constantly growth of population. Water is one of the fundamental assets which buttress financial development and keeps up everyday life. A water audit identifies and quantifies the water uses and losses from a water system. Water audits balance the amount produced with the amount billed and account for the remaining water. In water distribution network, it is being necessary tool to overcome shortage, leakage and losses of water. In this case study, water audit has been conducted for the distribution network of Rajarambapu Institute of Technology (RIT), Rajaramnagar campus, Maharashtra. The water audit includes calculation of system input, real losses and infrastructure leakage index to determine the demand-supply audit of water to balance it. According to this study water audit report shows that there is a slight variation in the average amount of water that is pumped to the overhead tanks everyday for various purposes and the average water consumption calculation.

Key words: Water Audit, Water Conservation, Water end-use survey.

1. Introduction

A water audit is an on-site survey and assessment of water using hardware like taps, showers, flushing equipments and management practices to determine the efficiency of water use. The water audit is a process in which the investigation of the overall water inputs and outputs of the water system. Water audits balance the amount produced with the amount billed and account for the remaining water. Water conservation and efficient utilization has the potential to reduce the huge investments required to expand water supply systems to meet the growing demand and will contribute immensely to sustainable development. The end use analysis is used to estimate the amount of water to be conserved and provides a

basis for development and evaluation of the demand management program end use efficiency. Water end use analysis defines the ways customers use water and it involves customer survey of water using appliances like taps and water closets (WC) and the water using practices such as frequency of WC flushing, bathing, cloth washing etc. The findings from the RIT case study are presented in this paper and recommendations are made for decision making in water demand management for institution campus.

2. Methodology

2.1 Study Area

Rajarambapu Institute of Technology, Rajaramnagar, Maharashtra has a green beautiful campus of 17 hectare area with student and staff population of about 4187. RIT has emerged as a leading technological Institute in Western Maharashtra. The RIT Campus having two areas of campus first one is RIT educational building area and second one is hostel or domestic area. The RIT Campus having total 30 buildings. The RIT campus has 11 buildings in hostel and domestic area. There are 8 hostels on campus with student population of about population of 1030. The water available in the college campus is come from MIDC Islampur and Islampur Municipal Corporation. This study attempts to access the per capita water use and the demand management measures that could be adopted to address the water stress situation and to develop water conservation plan for RIT Campus for improving water use efficiency.

2.2 Water end use survey

The water conservation program consists of three major steps. The first step is water audit, second one is intervention and third one is evaluation. The water audit includes pre-audit information, base lining and benchmarking and conducting a water audit at the building level. In pre-audit information included literature review study, inventory of water facilities, discussion with administrative and management officers. The base lining and benchmarking study included primary and secondary data collection. The questionnaire survey and sample survey in hostel area used to estimate individual water consumption. Secondary data collection included collections of water bills, records of water pumped to the overhead tanks to estimate actual supply. The water audit at the building level included calculations of water use and estimation of actual water supply.

2.3 Water flow rate experiments and estimation of water use quantities

The investigation of the existing water fixtures such as water closets, basin taps was taken during visits to the buildings in the campus. The flow rates of hand-wash basin taps utilized by the students and the volume of water per flush for WC were also determined in all the buildings. The duration while the water was running was used to compute the volumes of water used for bathing, washing clothes etc.

3. Results and discussion

3.1 Water end-use analysis

Water end-use analysis defines the ways customers use water and this involves a customer survey of water using appliances (water closet, showers, taps, etc.) and water-using practices such as frequency of shower use, frequency of cloths washing etc. To build up the total per capita water use using end-use analysis and to access the cost effectiveness of water demand management measures.

The numbers of students and staff members using building are 5470 at educational building area and 1030 at hostel area (Table 1). The respondents were students of RIT. In hostel area water use for drinking purpose was 5250 litres per day. Water use for cooking purpose was 5150 litrs per day. The water use for bathing was 30900 litres per day. The water use for washing clothes was 20600 litres day. The water use for flushing was 20619 litres per day. The water use for washing hands and face was 6058 litres per day. The water use for washing utensils in mess was 3600 litres per day. The water use for cleaning floors was 300 litres per day. The water use for gardening was 40020 litres per day (Table 3). The amount of water used by men's could be reduced if the time for allowing water to run and the flow of rate of showerheads are reduced.

Table1. Activity wise water use composition

Sr. No.	Activity of RIT Hostel Campus	Water use in litres/day	Percentage of Total Use	Litres per capita per day (lpcd)
1.	Drinking	5250	3.96	52.50
2.	Cooking	5150	3.88	51.50
3.	Bathing	30900	23.32	309.00

4.	Washing cloths	20600	15.54	206.00
5.	Toilet Flush	20619	15.56	206.19
6.	Basin	6058	4.57	60.58
7.	Washing Utensils	3600	2.71	36.00
8.	Mopping and cleaning	300	0.22	3.00
9.	Gardening	40020	30.20	400.20
	Total	**132497**	**99.96**	**1324.97**

3.2 Activity wise Total Water Use for RIT Hostel Campus in litres.

The composition of total water use for RIT hostel campus in litres is shown in figure1. The composition of total water use for RIT hostel campus in percentage is shown in figure 2. The composition of total water use for RIT hostel campus in lpcd is shown in figure3.

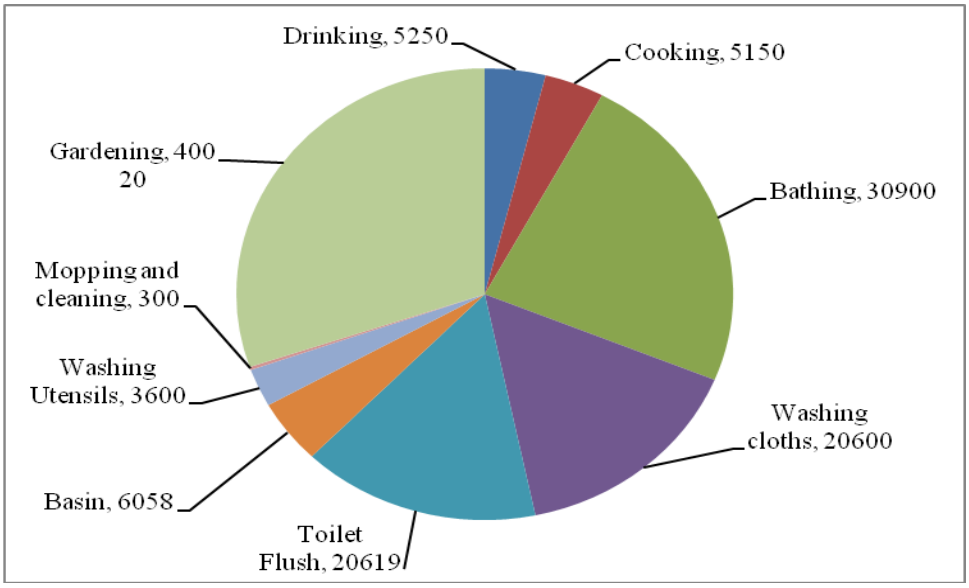

Figure1.Composition of total water use of RIT Hostel in li

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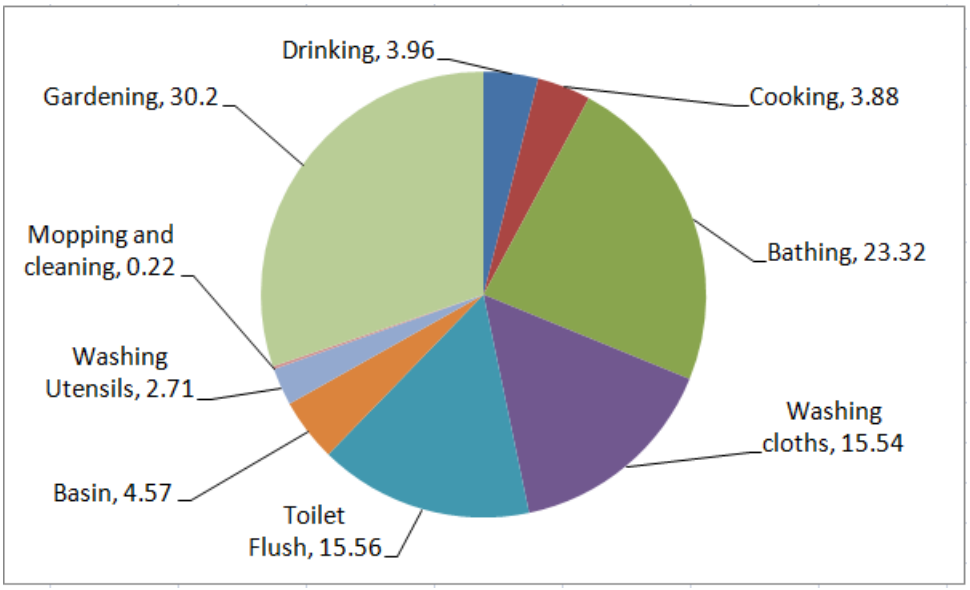

Figure2. Composition of total water use of RIT Hostel in percentage

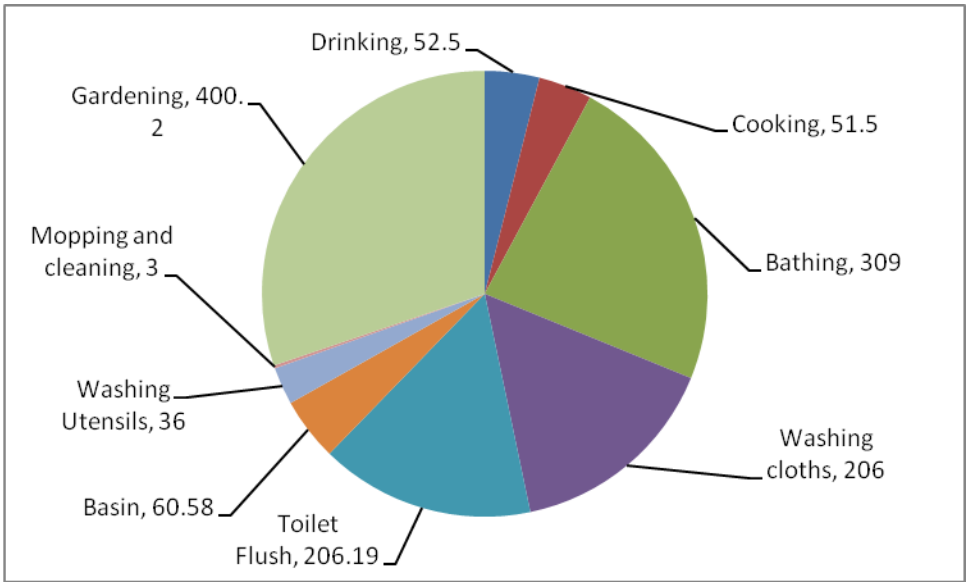

Figure3. Composition of total water use of RIT Hostel in lpcd

3.3 Data comparison and analysis

There is a slight variation in the average amount of water that is pumped to the overhead tanks everyday for various purposes and the average water consumption calculation.

Table2. Total water supply and use at RIT campus

Sr. No	Heads of Water Storage	Water Use in litres
1.	Average daily water supply to RIT Hostel campus	125000
2.	Total calculated water consumption from the water audit	132497
3.	Difference between water consumption from overhead tanks and actual water use for various purposes	7497

There were no visible leakages that were observed during the audit exercise at RIT. The difference between average daily water used from overhead water tanks and total calculated water consumption from the water audit is due to some assumptions are made during the calculation.

4. Conclusion

Based on the information collected and observations the following can be recommended to reduce water use and increase its efficiency.

- There is a necessary to develop a plan of rainwater harvesting for RIT Campus. Total rooftop area of RIT hostel campus is 4841.7 sq.m. which is useful to recharge underground water tanks.
- Replacements of single flush cisterns with dual flush cisterns in toilets. The dual flush cisterns uses only 2/5 litres or 2/4 litres . The dual flush system saves 30-40% water per day.
- The flow rate of taps, showers, wc flush can be reduced by using new technologies and by using sensors to avoid excess use of water. The air bubbles in the taps increases volume of flow water and simultaneously reduces flow without any effect on water flow.

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