

# WiseWater

User's

Manual



environmental  
management  
centre



**WiseWater** is a Microsoft Excel™ based spreadsheet application for projecting reductions in Water Consumption Patterns after application of Environmentally Sound Technologies (ESTs).

The present tool was developed by the Environmental Management Centre (EMC) and coordinated by Dr Prasad Modak. Other experts involved in the development were Kedar Kulkarni and Rahul Datar.

The development and the refinement of **WiseWater** as well as the Guidance Manual were supported by Dr.-Ing. Thorsten Schuetze, TU Delft; and Vicente Santiago, UNEP-DTIE-IETC.

Photo: Lake Biwa and Otsu City, Japan. Vicente Santiago

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The user should bear in mind that as any model **WiseWater** have limitations in its application. UNEP do not accept any liability for difficulties or costs incurred as a result of discrepancies due to its application.

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## Abbreviations

ESTs	Environmentally Sound Technologies
EDC	Every Drop Counts
UNEP	United Nations Environment Programme
DTIE	Division of Technology, Industry and Economics
IETC	International Environmental Technology Centre
TUD	Delft University of Technology
RWH	Rainwater Harvesting

## 1. Introduction to WiseWater

**WiseWater** is developed for capacity building and training purposes and serves as a complement to the main volume of this publication (**See Box 1**).

<i>Every Drop Counts: Environmentally Sound Technologies (ESTs) for urban and domestic water use efficiency</i>
<p><i>The focus of this sourcebook is efficient water use in urban and domestic environments and the context is on decision making about sustainable development of human settlements.</i></p> <p><i>The sourcebook is meant for politicians and other participants in decision making in the public sector dealing with water management with particular focus on water use efficiency and recycling in the urban and domestic environment.</i></p> <p><i>The objective of this sourcebook is to support the efforts by governments and decision makers in improving water use efficiency in the urban and domestic sectors through the application of Environmentally Sound Technologies (ESTs) as well as the Institutional strengthening in water use efficiency in the urban and domestic sector. Some of the key concepts will be introduced briefly in this section.</i></p>

### Box 1. Brief Note on Every Drop Counts

**About ESTs** – Environmentally Sound Technologies (ESTs) encompass technologies that have the potential for significantly improved environmental performance relative to other technologies. Broadly speaking, these technologies protect the environment, are less polluting, use resources in a sustainable manner, recycle more of their wastes and products, and handle all residual wastes in a more environmentally acceptable way than the technologies for which they are substitutes.<sup>1</sup>

#### 1.1 Objectives of WiseWater

**WiseWater** is a Microsoft Excel™ based tool designed to understand and experience application of ESTs for conservation of water by reducing consumption at household as well as at property level. It also incorporates a rainwater harvesting technology option at

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<sup>1</sup> Taken from the main volume of this publication

the Property level and a separate component to appreciate city level potential for rainwater harvesting.

## 1.2 Structure of the Tool

**WiseWater** is menu driven. User has four key options:

- Provide inputs
- Apply ESTs
- View outputs
- Edit ESTs

Accordingly, **WiseWater** has separate “worksheets”. Provisions are also made to view Help and access electronic version of the report “Every Drop Counts”. The structure of the tool consists of the following components:

**Data and Base Water Consumption Worksheet** – The user enters data concerning water consumption, population, areas and rainfall data for single as well as for multiple households on property and city level in this sheet.

**Water Consumption after ESTs Worksheet** – The user applies the ESTs in this sheet and is able to view the water consumption reduction after application of ESTs for Household and property (including rainwater harvesting at property level).

The **ESTs information** is provided at the end of this sheet that include technology descriptions and benefits of each ESTs. This information can be accessed by clicking on the button **ESTs Fact Sheet** on the top. By clicking on **Move to the Top** button, the user is taken to the top of the sheet again.

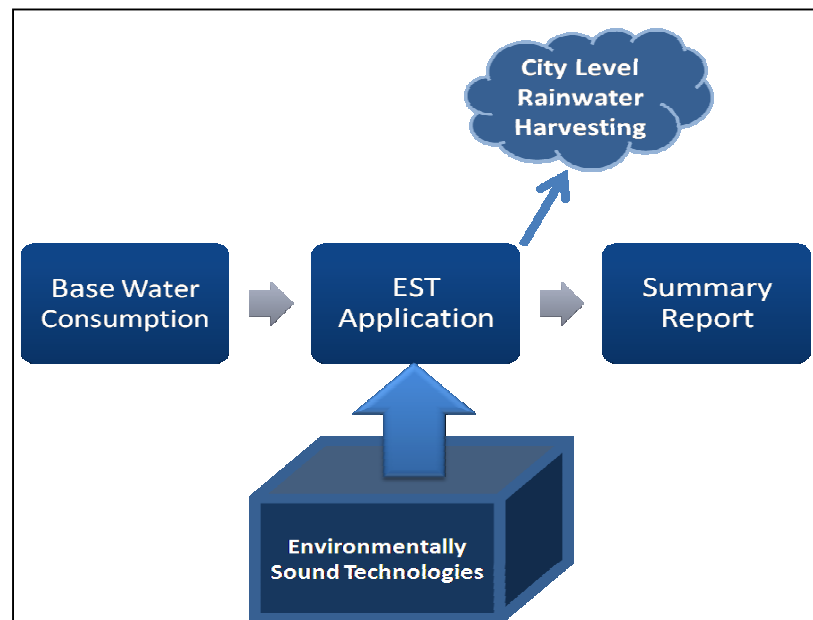


Figure 1. Structure of WiseWater

**Summary Worksheet** – A Comparative Summary report is displayed in this sheet which gives an overview of the total water consumption before and after the application of ESTs.

**ESTs Database Worksheet** – This is the main sheet which stores the EST information and which is accessed by the other sheets.

**City Level RWH Worksheet** – The city level rainwater harvesting potential information can be calculated in this sheet, which highlights the water that can be augmented using rainwater at the city level.

### 1.3 Scope, Assumptions and Limitations

**WiseWater** is currently developed for domestic water use covering drinking and service water uses such as laundry, washing and sanitation.

**WiseWater** accounts for water consumption at household and property levels. Property level water consumption is derived from household water use depending on the number of individuals dwelling in a property.

It is assumed that water consumption is common across all households in a property.

Water consumption pattern is calculated after inclusion of the water losses during distribution.

City level computations of water consumption are currently not possible as commercial and industrial water uses are not addressed.

Rainwater that is harvested from the roof of buildings is stored to satisfy the volume of water required for service water demand. The storage volume is generally based on the service water demand of 2 to three weeks but can be modified to allow for instance a higher coverage rate of the service water demand by stored rainwater.

A model for city level estimation of rainwater that can be harvested is however provided.

Default values where applicable are provided. For better appreciation, summaries and graphs are generated as data on inputs is entered. Appropriate data validation checks are built in to eliminate possible data entry errors.

*Limitations for Macintosh users*

*Not all features of WiseWater are working properly on Microsoft Excel™ for Mac. The reason is that Microsoft Excel™ for Mac cannot run Visual Basic macros or load add-ins that contain Visual Basic macros.*

## 2. How to Use WiseWater

### 2.1 Getting Started

The **WiseWater** folder on the CD ROM should be copied on your hard disk before use to access full functionality of the tool. ***Before you begin, please ensure that you have copied the WiseWater spreadsheet, User manual, Manual on "Every Drop Counts" in the folder where you have copied WiseWater.***

For Microsoft Excel™ 2000, XP, and 2003 and 2007 Users: Before opening the Tool, make sure that the security level has been changed to medium. This is essential as some features of the tool might not run at all or run efficiently.

Run Excel™ on your computer. The security option can be found at Tools →Macro →Security (See Figures 2 and 3):

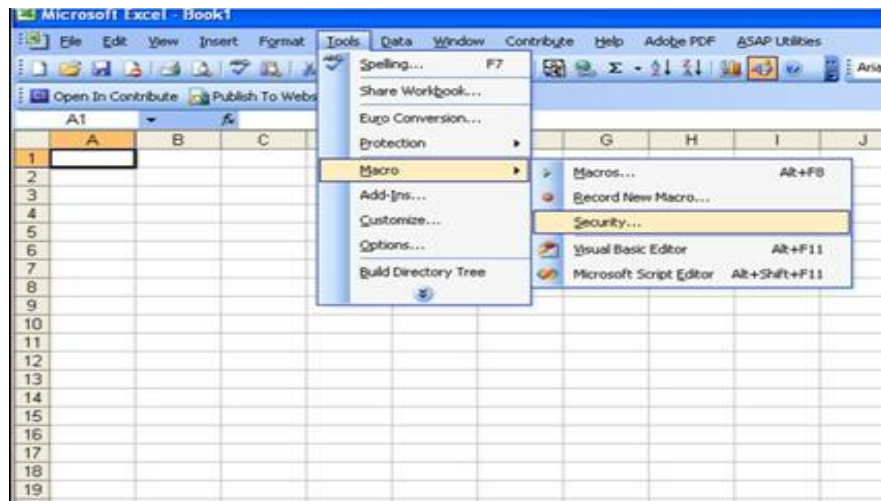


Figure 2. Setting Level of Macro Security

Make sure that the button next to **medium** is selected (See Figure 3):

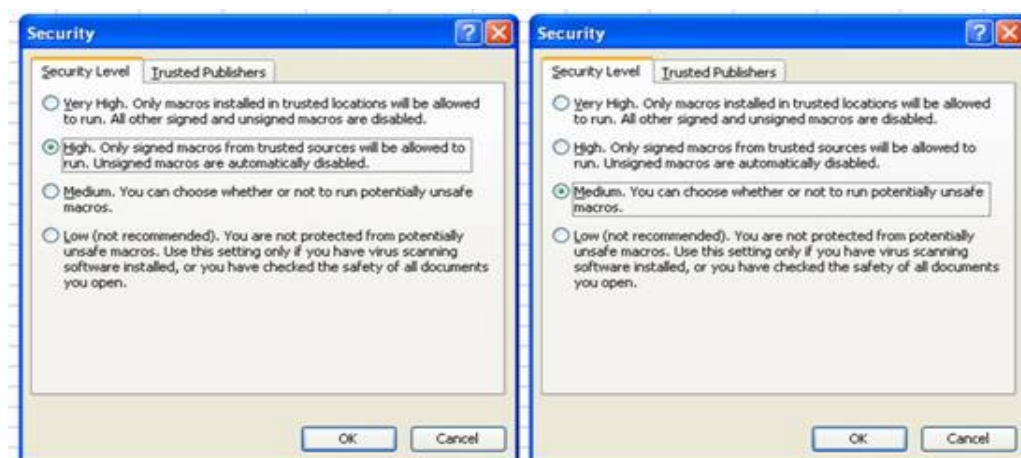


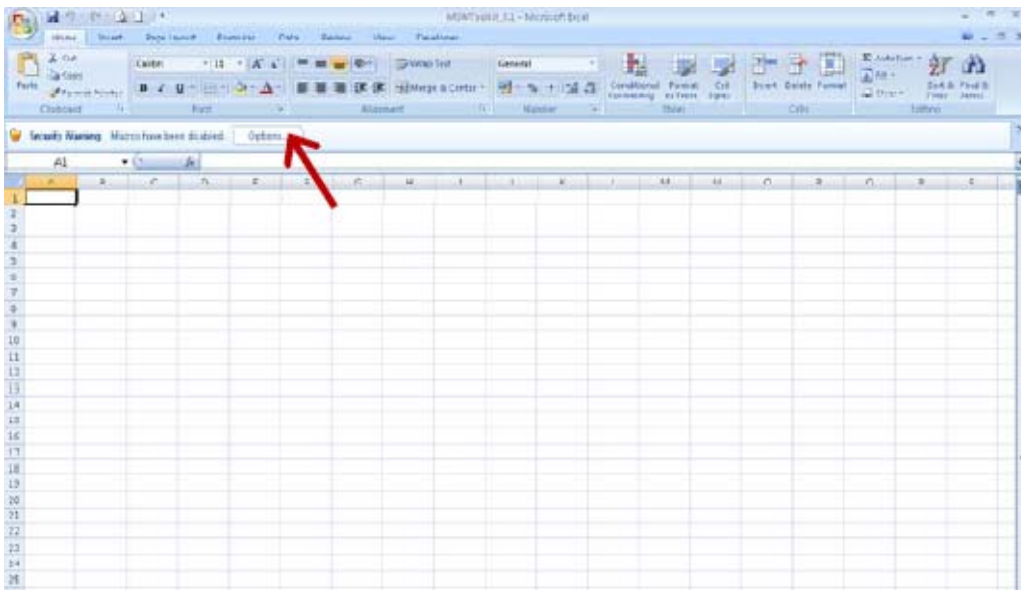
Figure 3. Changing Security Level to Medium

After completing these steps, exit Excel™ and open **WiseWater**. A Security warning dialogue box will appear. Click on Enable Macros to proceed (See Figure 4).



**Figure 4. Enabling Macros for WiseWater**

For Excel™ 2007 users, simply click on “Options” and the Security warning when the window opens.



**Figure 5: Selecting Options in Excel™ 2007**

And select enable macros.

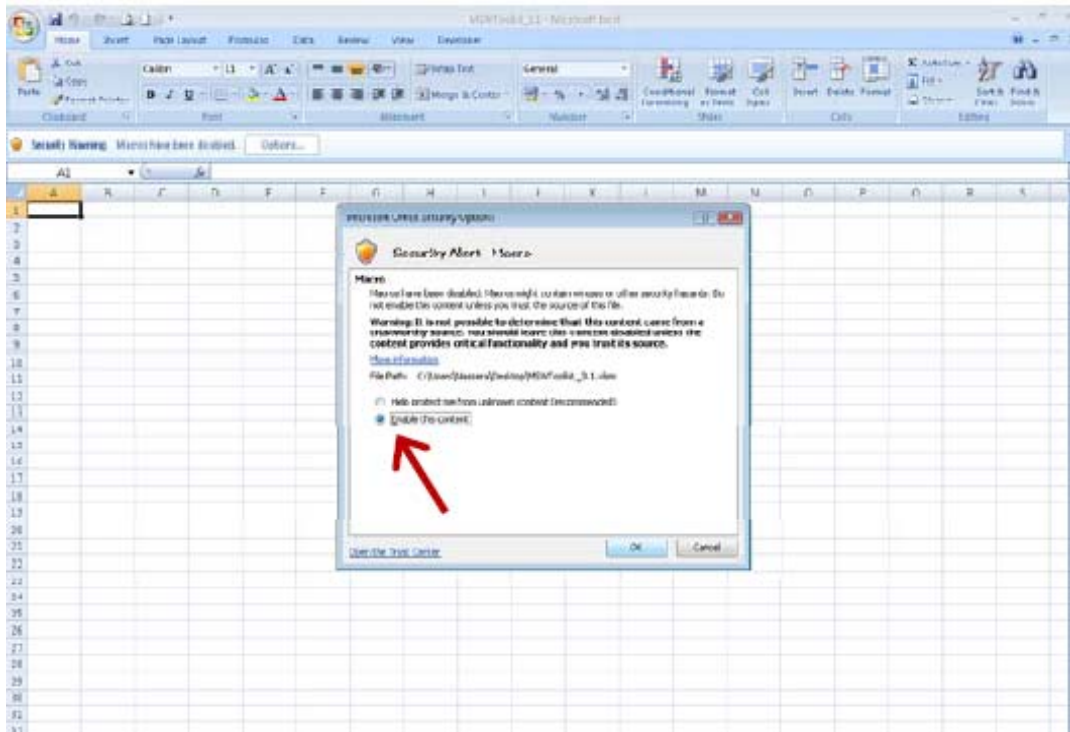


Figure 6: Macro Enabling in Excel 2007

The ideal screen resolution while **WiseWater** usage should be 1024 x 768 or 1280 x 1024 pixels. The spreadsheet does work at other resolutions but best view is possible at these resolutions.

*Note:*

*The screens shown in various figures in this manual are only illustrative and do not necessarily indicate the default scenario when the WiseWater spreadsheet is opened.*

## 2.2 Main Menu

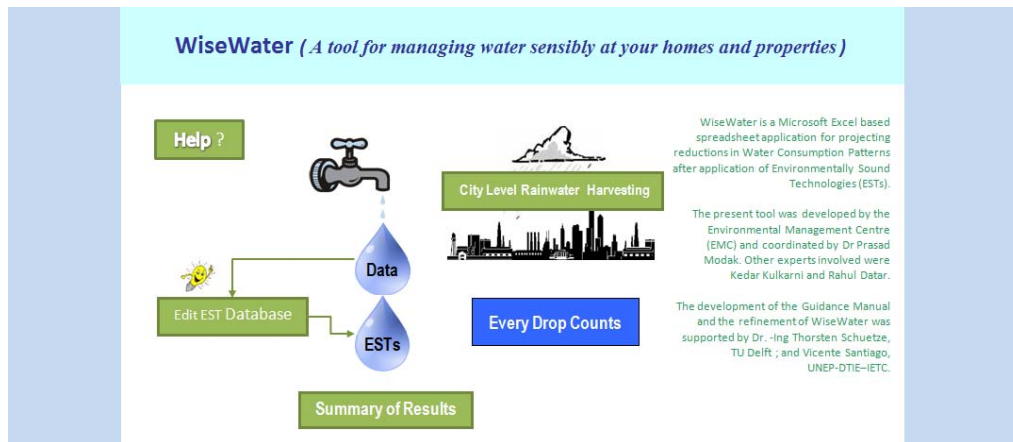


Figure 7. Main Menu – WiseWater

After starting, **WiseWater** Main Menu will appear (See Figure 7). Several options are available.

For example, clicking on “Data” will take the user to the Base Water Consumption sheet. On every sheet a navigation arrow is present which when clicked takes the user back to the Main Menu (See Figure 8).

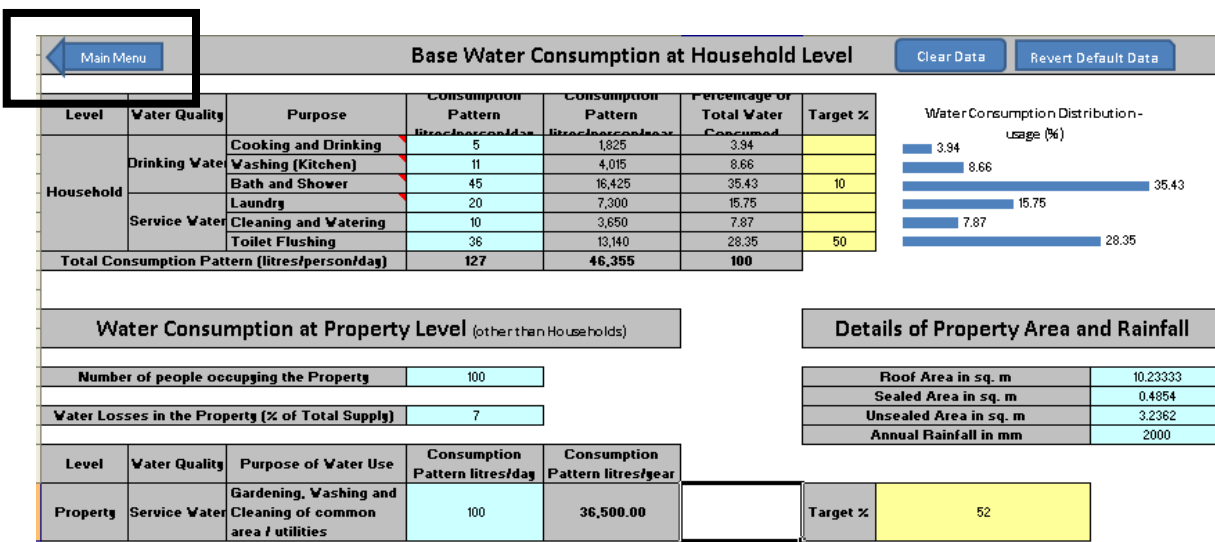


Figure 8. Returning to Main Menu

## 2.3 Entering Household and Property Level Water Consumption

The Base Water Consumption Worksheet is divided into three main sections:

- Water Consumption at Household Level

In this section the user enters the values for drinking water and service water usage at household level. The data entry cells are highlighted as light green. Various uses of drinking as well as service water are also defined under the column of Purpose (See Figure 9). *Please note that values entered should be present consumption figures without the influence of any ESTs that may have been already applied.*

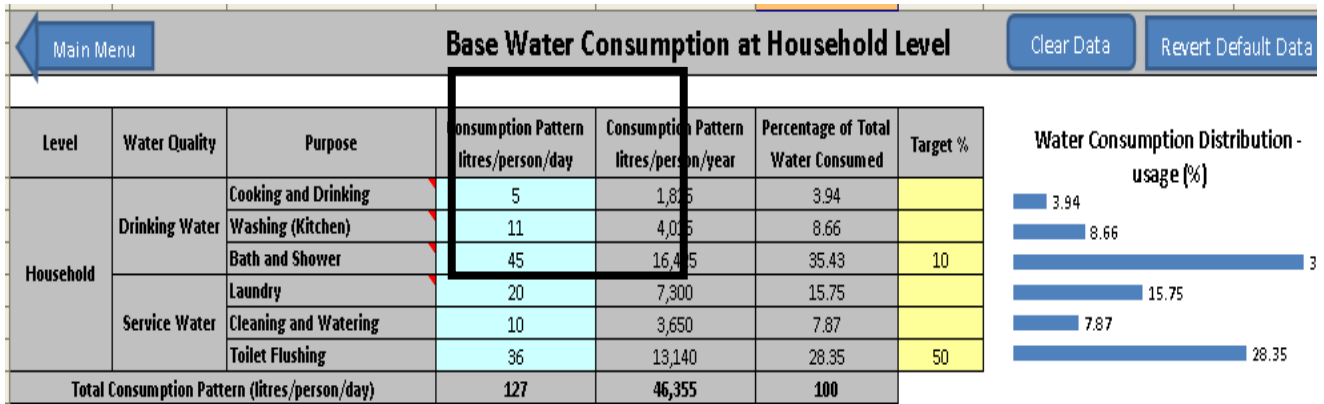


Figure 9. Household Level Water Consumption Section

The Base Water Consumption pattern is to be entered as litres / person / day. Users can enter **target levels** as desired percent reduction in household water consumption in the right most column (cells highlighted as yellow). Targets can be set for each purpose.

Calculations are then done on the basis of litres / person / year and distribution of water consumption pattern is mapped in terms of bar diagram as shown in **Figure 9**. This statistics should be used to assess which water use should be the focus e.g. laundry or bath water, to reduce water consumption at household level.

Button is provided captioned “**Clear Data**” to clear all data inputs. “**Restore Default Data**” allows to restore default values on Base Water Consumption as provided in **WiseWater**.

- Water Consumption at Property level

This section captures the Property level pattern of water consumption. Here, user should enter the number of inhabitants in the property, water consumption at the property level for purposes other than those at the household level, details on property area and rainfall and water losses during distribution of water at the property. In addition, target can be entered for water use reduction at the property level (See Figure 10).

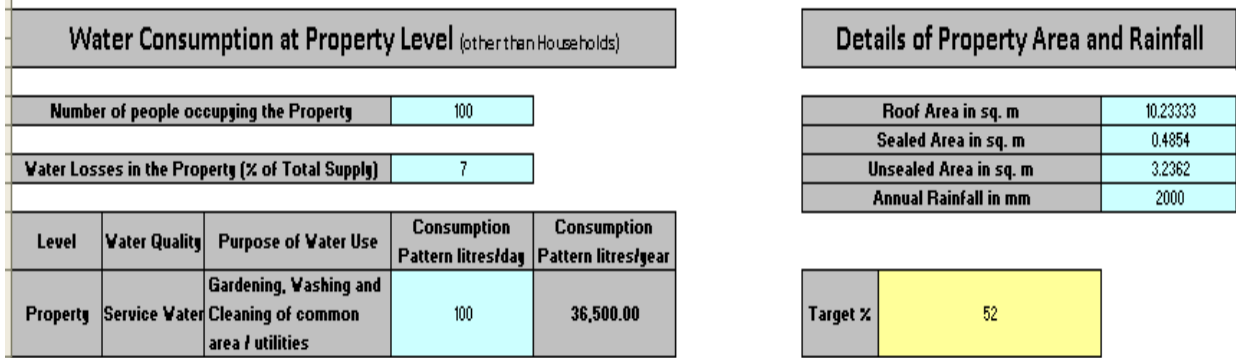


Figure 10. Water Consumption at Property Level

- Water Consumption summary without application of ESTs

After entering the data for base water consumption, a section summary is displayed (See Figure 11). This summary shows various statistics at household level and property levels across drinking and service water uses factoring water distribution losses. This statistics should be used to assess what should be the focus area e.g. drinking or service water, to reduce overall water consumption at the property level.

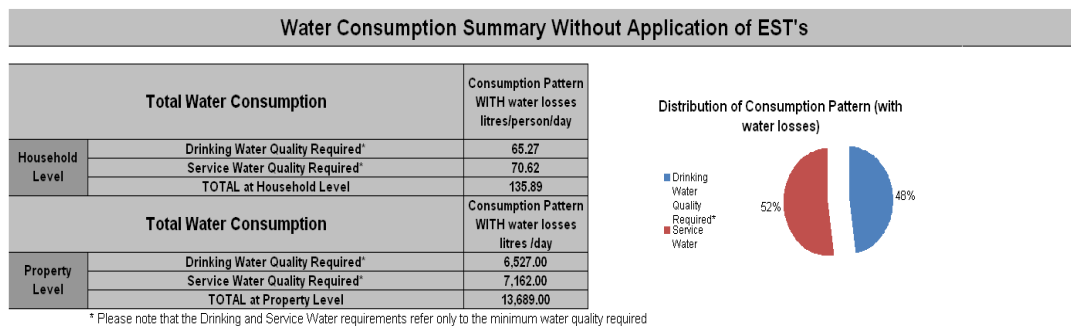


Figure 11. Summary of Water Consumption without Application of ESTs

## 2.4 Applying ESTs and Entering Rainwater Harvesting Data

**WiseWater** provides for four types of ESTs. ESTs that

- Reduce water use at source
- Allow recycling of used water
- Reduce water losses in distribution
- Complement or augment water resource

ESTs that lead to water use reduction consist of retrofitting/adding fixtures. ESTs for recycling use principle of segregation and treatment technologies. ESTs for augmenting water resource consist of rainwater harvesting, arresting of leaks etc.

For each ESTs, **WiseWater** maintains a database in the form of a “fact sheet”. These sheets are possible to view as well as edit. At present, it is not possible to add new ESTs to the ESTs database.

After entering the water use data, user can make a choice of ESTs. The ESTs factsheets are provided at the end of the sheet that include technology descriptions and benefits of each ESTs. These factsheets can be reached by using the button on the top of the sheet and clicking on the “Go to Top” area will return the view to the top of the sheet again.

For each water use, **a drop box (See Figure 12)** is provided to allow the user a choice of applicable ESTs. Information on the ESTs can be accessed to assist in making choice on ESTs. At any time, only one ESTs can be applied.

Based on the application of ESTs, new pattern of water consumption is computed and revised statistics and graphs are shown the user. Status on targets set on the household water consumption is also shown. Based on the status, the user can make new or different choices of ESTs and try to meet the targets.

Main Menu		EST Fact Sheet		Application of EST's				Remove EST's	
Water Consumption at Household Level									
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	
Type of EST	Appicability of EST	Water Quality	Purpose of Water Use	Environmentally Sound Technologies	Water Reduction litres/person/day	New Consumption Pattern - (litres/person/day)	New Consumption (litres/person/year)	Target Status	
Water Saving	Households	Drinking Water	Cooking and Drinking	No Reduction	0.00	5.00	1,325.00		
			Washing (Kitchen)	No Reduction	0.00	11.00	4,015.00		
			Bath and Shower	Water Saving Showerhead	5.40	39.60	14,454.00	Ok	
		Service Water	Laundry	No Reduction	0.00	20.00	7,300.00		
			Cleaning & Watering	No Reduction	0.00	10.00	3,650.00		
			Toilet Flushing	Water Saving Toilet Dual Flush 2/3L	23.00	13.00	4,745.00	Ok	

Figure 12. Selection of ESTs via Drop Box

This worksheet is divided into three main sections and further subsections viz:

- Application of ESTs
  - At Household level

In this section, ESTs that reduce water consumption at household level can be applied. (See Figure 13).

Main Menu		EST Fact Sheet		Application of EST's				Remove EST's	
Water Consumption at Household Level									
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	
Type of EST	Appicability of EST	Water Quality	Purpose of Water Use	Environmentally Sound Technologies	Water Reduction litres/person/day	New Consumption Pattern - (litres/person/day)	New Consumption (litres/person/year)	Target Status	
Water Saving	Households	Drinking Water	Cooking and Drinking	No Reduction	0.00	5.00	1,325.00		
			Washing (Kitchen)	No Reduction	0.00	11.00	4,015.00		
			Bath and Shower	Water Saving Showerhead	5.40	39.60	14,454.00	Ok	
		Service Water	Laundry	No Reduction	0.00	20.00	7,300.00		
			Cleaning & Watering	No Reduction	0.00	10.00	3,650.00		
			Toilet Flushing	Water Saving Toilet Dual Flush 2/3L	23.00	13.00	4,745.00	Ok	

Figure 13. ESTs for Water Consumption at Household Level

The ESTs available for this section based on the water use are:

Water Use	Available ESTs
<b>Drinking Water</b>	
Cooking and Drinking	1. Water Saving Taps – Kitchen
Washing (Kitchen)	1. Water Saving Taps and Dishwasher
Bath and Shower	1. Water Saving Taps – Bath 2. Water Saving Showerhead 3. Water Saving Taps and Showerheads
<b>Service Water</b>	
Laundry	1. Water Saving Behaviour an Household appliance
Cleaning and Watering	1. Water Saving Behaviour an Household appliance
Toilet Flushing	1. Compost Toilets 2. Pre Compost Toilets 3. Dehydration Toilets 4. Waterless Urinals 5. Water Saving Toilet single flush (1) Litres 6. Water Saving Toilet dual flush (1 / 6) Litres 7. Water Saving Toilet dual flush (2 / 3) Litres 8. Water Saving Toilet dual flush (4 / 6) Litres
<i>Each category also has an option of "No Reduction" or no ESTs choice</i>	

**Table 1: ESTs Available for Household Level**

○ At Property Level

In this section, user can select ESTs applicable at property level mainly for the purposes of greywater and blackwater recycling (**See Figure 14**).

Managing Water Consumption through Recycling at Property Level						
Type of EST	Applicability of EST	Water Quality	Purpose of Water Use	Environmentally Sound Technologies - Recycling	Water Reduction litres/day	Service Water Demand
Water Recycling	Property	Service Water	Cleaning / Laundry / Toilet	No Recycling	0.00	4,662
				<ul style="list-style-type: none"> <li>No Recycling</li> <li>Greywater from Bathrooms</li> <li>Greywater from Kitchens</li> <li>Greywater from Bathroom and Kitchen</li> <li>Blackwater</li> <li>Greywater + Blackwater</li> </ul>		

Controlling Water Losses at Property Level				
Type of EST	Applicability of EST	Water Quality	Environmentally Sound Technologies	New Water Losses in the Property (% of Total Supply)
Water Supply and Distribution	Property	Service and Drinking Water	Water Supply Pressure Reducer	3.50
			<ul style="list-style-type: none"> <li>No Reduction</li> <li>Water Supply Pressure Reducer</li> <li>Savings by Leakage Control</li> </ul>	

**Figure 14. ESTs for Water Consumption at Property Level**

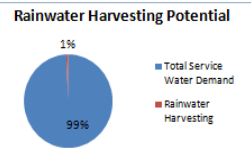
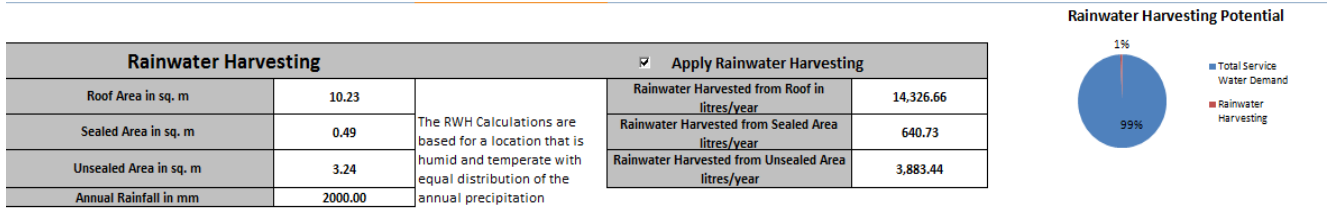
The ESTs available for this section are:

Type	Available ESTs
Managing water consumption through Recycling	<ol style="list-style-type: none"> <li>1. Greywater recycling from Bathrooms (includes laundry wastewater)</li> <li>2. Greywater Recycling from Kitchens</li> <li>3. Greywater recycling from Bathroom (includes laundry wastewater) and Kitchens</li> <li>4. Blackwater Recycling</li> <li>5. Greywater + Blackwater recycling</li> </ol>
Controlling water losses at property level	<ol style="list-style-type: none"> <li>1. Savings by leakage control</li> <li>2. Water supply pressure reducer</li> </ol>

**Table 2: ESTs Available for Water Recycling**

Rainwater Harvesting

The rainwater harvesting section considers water harvesting potential at the property level. To activate this option, box which states “Apply Rainwater Harvesting ESTs” needs to be checked (Check arrow in **Figure 15**).



**Figure 15. Applying Rainwater Harvesting**

Controlling losses at property level

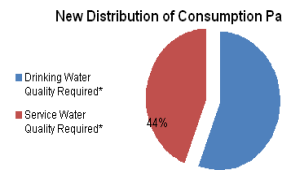
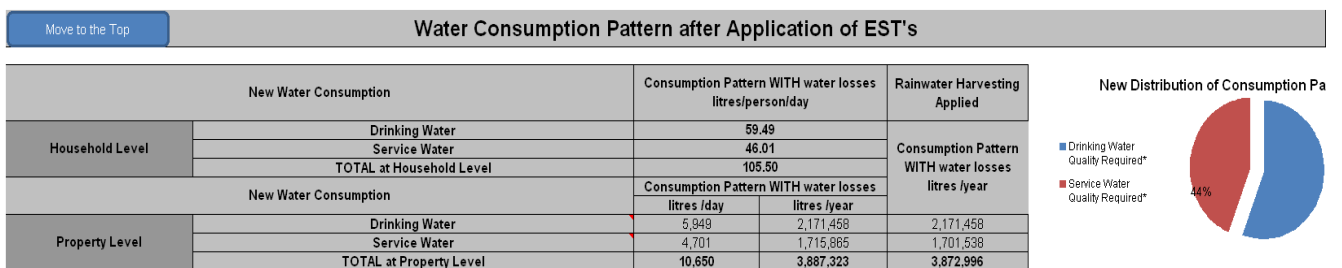
Water consumption at the property level can be reduced by controlling water losses through distribution pipes. Table 3 shows the ESTs available for controlling water losses.

Type	Available ESTs
Water Supply and Distribution	<ol style="list-style-type: none"> <li>1. Leakage loss reduction</li> <li>2. Water pressure reducers</li> </ol>

**Table 3: ESTs for Controlling Losses at Property Level**

Water Consumption summary after application of ESTs

After the user applies the ESTs, a summary is displayed which projects the New Water Consumption Pattern (See Figure 16). Relevant statistics and graph are shown.



**Figure 16. Water Consumption Patter after Application of ESTs**

## 2.5 Summary

In the Summary worksheet, user gets an opportunity to view the results and understand the changes in the water consumption pattern – both at household and property levels. A histogram based comparative assessment is provided across water use (drinking and service water) for better appreciation (See Figure 17).

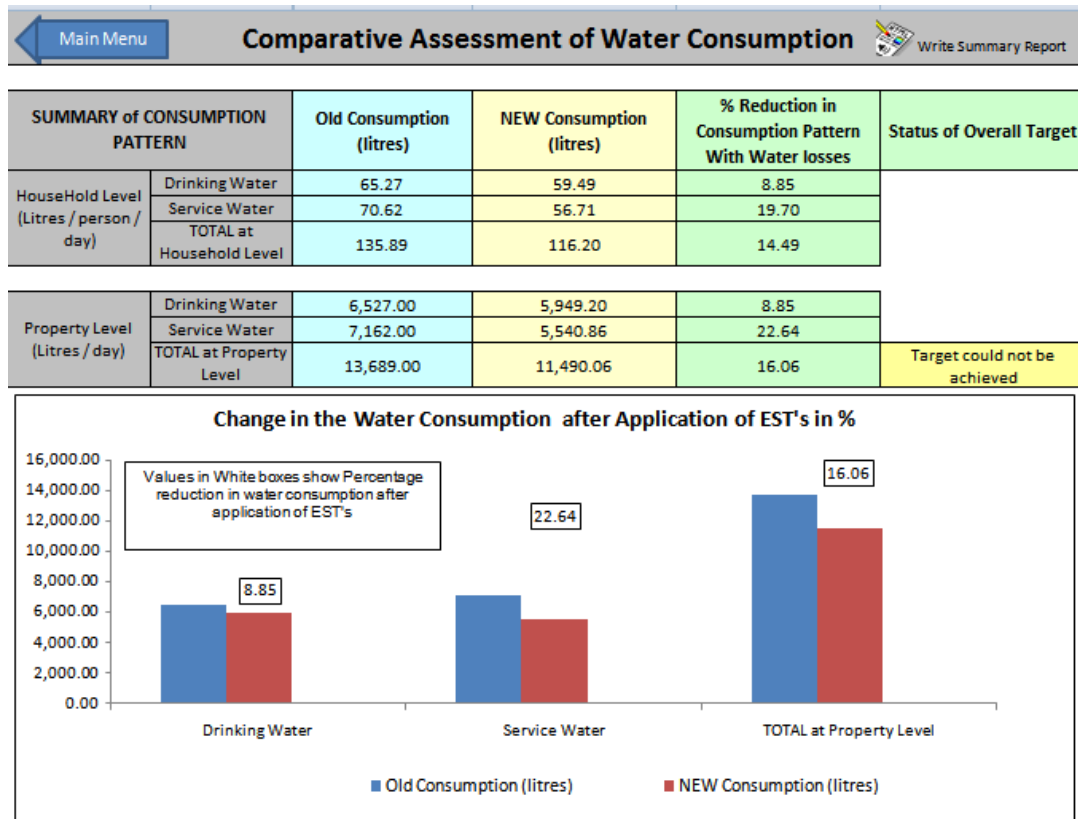
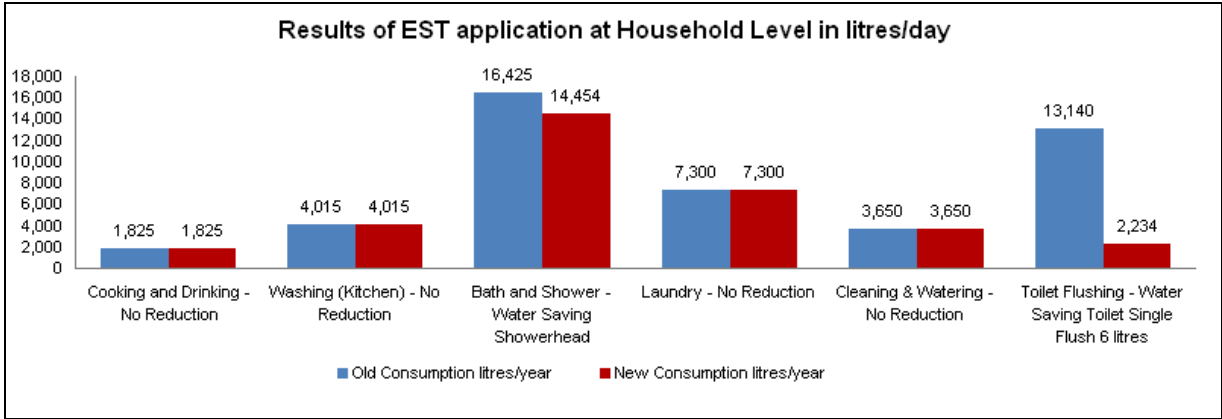


Figure 17. Summary Page – Tabular Data

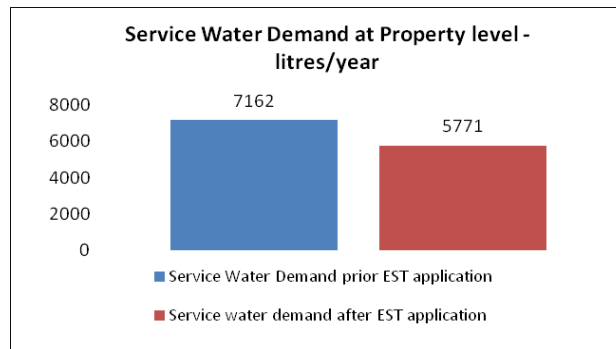
The other graphs on the summary worksheet include:

- Results by ESTs at household level, which compare the scenario of water consumption before and after ESTs application. This graph enables understanding of the effectiveness of each ESTs that is applied or chosen.



**Figure 18. Results of ESTs Application at Household Level**

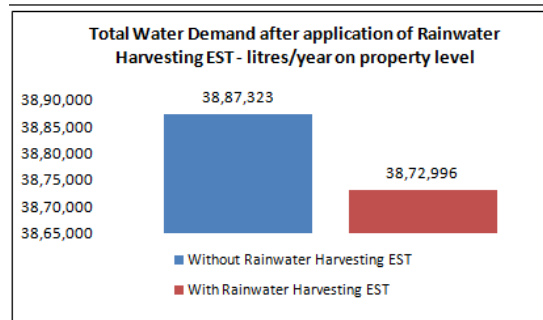
- Service water demand at property level in litres/year, which compares the water consumption for service water before and after application of ESTs.



**Figure 19. Service Water Demand at Property Level**

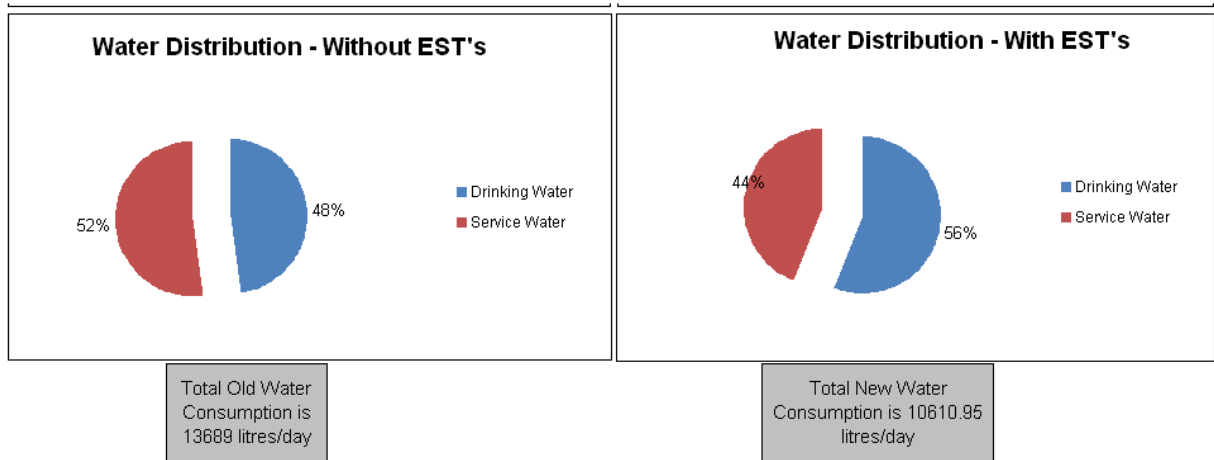
This graph assists in understanding the benefit of recycling technologies.

- Total water demand before and after application of rainwater harvesting:



**Figure 20. Benefits of Rainwater Harvesting**

- Water consumption distribution before and after application of ESTs which show the change in distribution pattern after application of ESTs.



**Figure 21. Water Consumption Distribution across Water Uses before and after application of ESTs**

The user can also generate a report based on this summary information by clicking on the button “Write Summary Report” and specifying the desired filename. The report is saved in an HTML format in the same folder as **WiseWater**.

### 3. Editing ESTs Database

The ESTs database provided in **WiseWater (Figure 22)** has been developed based on information from the ESTs Sourcebook “Every Drop Counts” and by drawing experience of several international water experts. This database is used as a basis for computing water use reductions.

It is possible for the user to edit the ESTs related information to some extent based on new data or to factor site specific considerations. **WiseWater** allows user to make such changes for some of the ESTs on percent water reduction (column H) to customize the application.

Please note that users are not allowed edits for reduction percentage on ESTs such as wastewater recycling, toiler flush and rainwater harvesting. The reason being that these ESTs have fixed reductions based on the choice one makes and hence user needs no control over the reductions. A button is provided to restore editable cells in column H to the default values.

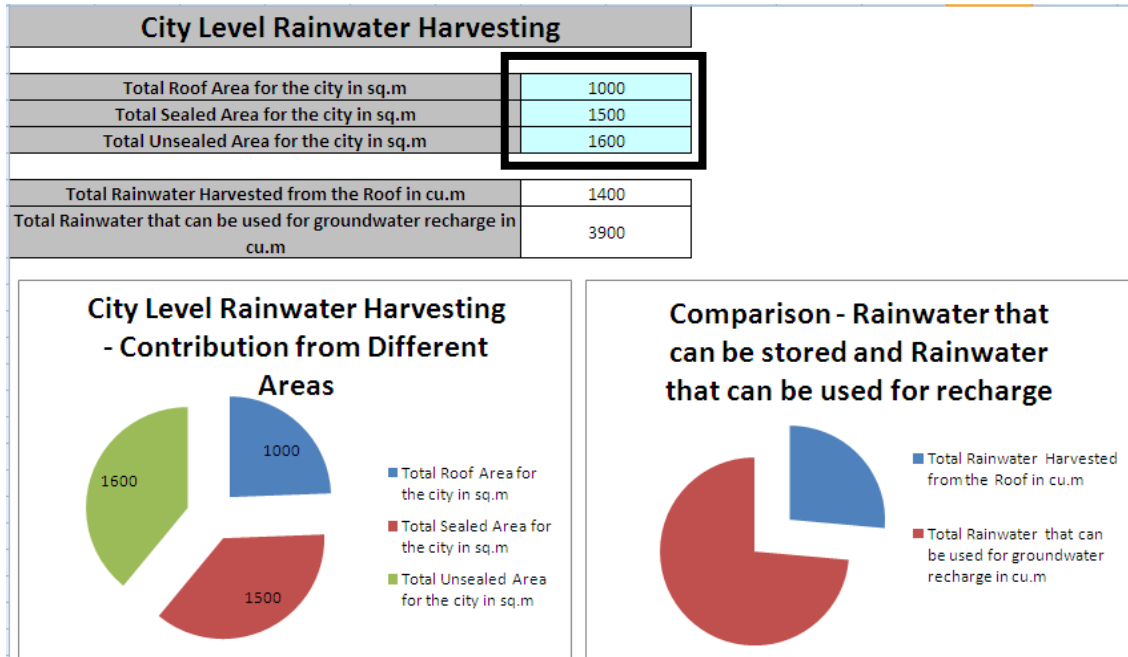
## Editable part of the ESTs Database:

WATER SAVING DOMESTIC ENVIRONMENT - ESTs FOR WATER USE EFFICIENCY IN THE FRAMEWORK OF URBAN WATER MODEL											
Location in urban environment	Required water quality	Purpose of water use	Watersaving technology (overall)	Water saving technology (specific)	Water consumption (per person and day)	Estimated water use reduction (compared with)	savings in relation to	savings in relation to total	savings in relation to total	Conditions for Applicability (e.g.)	
										Qualitative	Quantitative
Drinking Water	Drinking Water	Nutrition	Tap	kitchen taps cooking and drinking	4 litres	1 litres	25%	1%	1%	The specific flow rate should be adapted to the specific use of taps.	existing water network and technology
		Cleaning dishes	Tap or household appliance	kitchen dishwash by hand or machine	8 litres	3 litres	38%	2%	2%		
		Body care	Showerhead	bathroom showerheads	29 litres	5 litres	17%	4%	4%	shower heads are meeting the comfort criteria of the users	
		Body care	Tap	bathroom taps	9 litres	1 litres	11%	1%	1%	The specific flow rate should be adapted to the specific use of taps.	existing water network and technology
		Laundry	Behaviour or household appliance	laundry (by hand or machine)	12 litres	8 litres	67%	6%	6%		
		Cleaning and watering	Tap and behaviour	taps cleaning and plants	5 litres	5 litres	100%	4%	4%		
					Waterless toilet	compost toilets	0 litres	36 litres	100%	28%	26%
				pre-composting toilet	0 litres	36 litres	100%	28%	26%	Suitable for all urban and domestic areas in areas with sewer system without central water supply	
				Waterless toilet						Suitable for all urban and domestic areas	

Figure 22. Editable Part of ESTs Database

## 4. City Level Rainwater Harvesting

This worksheet assists in understanding City Level Rainwater Harvesting Potential. For this purpose, user has to enter city level rainfall and relevant spatial information (See **Figure 23**). This information could then be used to promote rainwater harvesting and strategies like ground water recharge.



**Figure 23. City Level Rainwater Harvesting**

## 5. Illustrative Example on WiseWater

A property is asked by the City Council to reduce water consumption by 20%. This property has 100 individuals living in apartments. These individuals set up a committee to look into various options to reduce water consumption. The committee decided to use **WiseWater** tool for this purpose.

On discussions, the committee considered specific targets for certain water uses based on information on water use and experience at other properties. These targets were as below:

- 10% reduction in bath and shower water consumption (T1)
- 50% reduction in Toilet water consumption (T2)

Initially, two ESTs were considered for these water uses. For bath and shower, ESTs of Water Saving Showerheads was applied. For toilet water, water saving toilet (1 litre saving) was opted as the ESTs. **WiseWater** calculated the savings in water consumption and reported the following:

- Water Saving Showerheads met the target of 10% water consumption reduction
- Water Saving Toilets (1 litre) however did not satisfy the target of 50% reduction

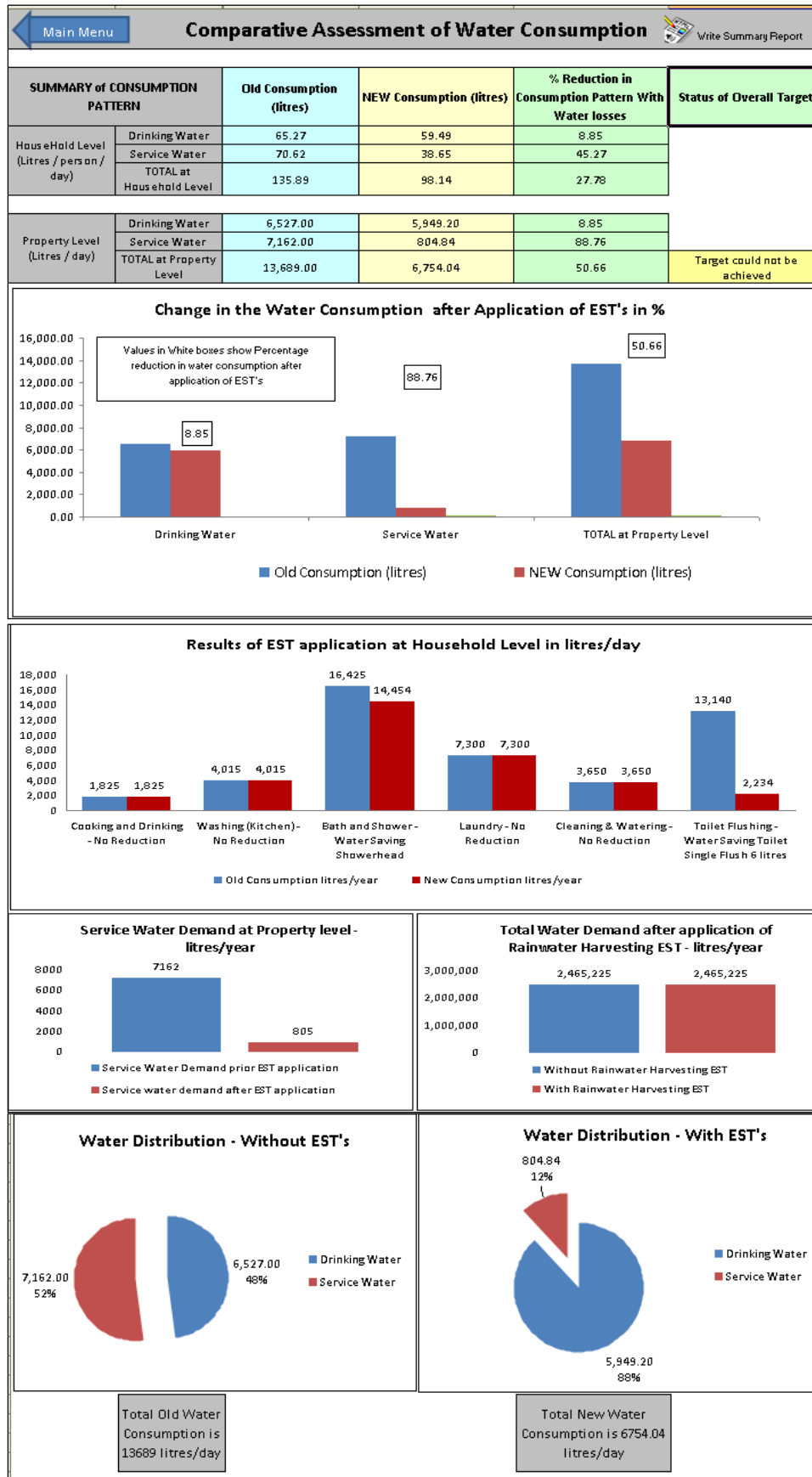
Hence, ESTs of Water Saving Toilets (1 litre consumption per flush) was applied. This ESTs met the required target. It was noticed however that the property level target of 20% reduction could still not be met.

To meet this target, ESTs of greywater recycling from Bathroom and Kitchens was chosen. Although the overall property level water consumption was reduced, the target was not met. Hence, it was decided to explore harvesting rainwater. A storage of 3 weeks was considered in sizing the rainwater harvesting tank.

**WiseWater** reported that now the target of 20% reduction at property level could be met. In essence, a wise combination of ESTs could help.

Tool like **WiseWater** can be used in an iterative manner and in steps to arrive at optimal combinations of ESTs.

The committee submitted a report from **WiseWater** to the City Council. Extracts of the HTML report are shown in **Figure 24**. The City Council was indeed pleased with the submission. The Committee however recommended that ESTs on reducing water losses could also be considered. There was also a suggestion to “fine tune” the ESTs database by consulting with the local technology/equipment suppliers.



**Figure 24. Summary HTML Report Prepared for City Council**