Rainwater Harvesting in the Caribbean

RWH Technical Fact Sheet 3A:

Estimating Storage Requirements

1. Dry period demand method

In this approach one simply estimates the longest average time period without any rainfall for your particular geographic area. This will typically coincide with the dry season which in the Caribbean islands, generally runs from January to May. Your local meteorological office can be consulted to get such estimates. Hence, if your household daily demand is 100 litres and the dry season runs on average for 120 days, then the size of your storage should be 12,000 litres or 2,639.64 gallons.

2. Simple method

In this method, the average annual water consumption is estimated for the household, based on the number of occupants. The average duration of the longest rainless period is also assumed in terms of number of days. This rainless duration period is in turn expressed as a ratio (of the duration of a year) and multiplied by the annual consumption to estimate the volume of water that will be required for this period.

A worked example:

- Consumption per person per day, C = 40 litres
- Number of people per household, n = 5
- Longest average dry period = 25 days
- Annual consumption (litres) = C x n x 365

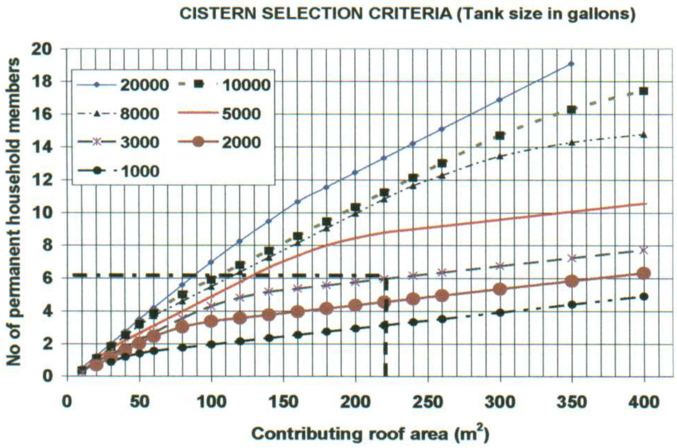
Annual consumption 40 x 5 x 365 = 73,000 litres (16,058 gallons)

Storage requirement, T = 73,000 x 25 / 365 = 5,000 litres (1,099.85 gallons)

(**Source:** School of Engineering, University of Warwick, Development Technology Unit, 2008 http://www2.warwick.ac.uk/fac/sci/eng/research/dtu/rwh/sizing/)

3. Graphical Method

Using the graphical method, one only needs to know the number of persons in the household and the approximately roof area. The graph in below can be used to determine the recommended size of the storage. The graph shows a plot (dashed line) for tank size selection for a roof area of approximately 225 m^2 and a household size of 6 persons. The plot suggests that a 3,000 gallon (13,638 litre) storage tank is recommended.



Graphical guide to tank size selection (Peters 2003)
(http://www.uwichill.edu.bb/bnccde/svg/conference/papers/peters.html)

Collaborative production between the Caribbean Environmental Health Institute and the United Nations Environment Programme

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RWH Technical Fact Sheet 3B: *Estimating Storage Requirements: Method 4 - Simple Tabular Method*

STEP 1: Obtain rainfall data for your area. This may be obtained from your local meteorological office. It is recommended that you use data from a notably dry year so as to better ensure considerations are made for prolonged dry spells (SOPAC RWH Manual 2004). It is also noted that average values should not be used (however in this case we will use average rainfall data from Union Island in St. Vincent and the Grenadines solely for illustration. Data source: Peters, 2003)

STEP 2: Estimate the potential volume of water that can be harvested from your roof.
Assume the following:
Roof area: 80 m^2
Runoff coefficient: 0.9 (for a metal sheet roof)
Volume captured (litres) = rainfall (mm) x roof area (m^3) x runoff coefficient)
Volume captured in January (litres) = 66 mm x 80 m^2 x 0.9 = 4,752 litres (1,045.30 gallons)

STEP 3: Estimate monthly demand.
Assume the following:
Number of persons in the household: 5 persons
Average water consumption per day: 40 litres
Average number of days in the month: 30.4 days
The total monthly demand (litres) = No. persons x daily water consumption x no. days per month
Total monthly demand (litres) = 5 x 40 x 30.4 = 6,080 litres (1,337.42 gallons)

Rainfall data & capture

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rainfall (mm)	66	46	36	40	63	105	130	148	122	154	165	104	1179
Vol capture (litres)	4,752	3,312	2,592	2,880	4,536	7,560	9,360	10,656	8,784	11,088	11,880	7,488	84,888

A	B	C	D	E	F	G
Month	**Volume captured in month**	**Cumulative volume captured**	**Volume demanded in month**	**Cumulative demand**	**Total amount stored** *(column C minus column E)*	**Deficit/surplus for month** *(column B minus column D)*
April	2,880	2,880	6,080	6,080	-3,200	-3,200
May	4,536	7,416	6,080	12,160	-4,744*	-1,544
June	7,560	14,976	6,080	18,240	-3,264	1,480
July	9,360	24,336	6,080	24,320	16	3,280
August	10,656	34,992	6,080	30,400	4,592	4,576
September	8,784	43,776	6,080	36,480	7,296	2,704
October	11,088	54,864	6,080	42,560	12,304	5,008
November	11,880	66,744	6,080	48,640	18,104	5,800
December	7,488	74,232	6,080	54,720	19,512*	1,408
January	4,752	78,984	6,080	60,800	18,184	-1,328
February	3,312	82,296	6,080	66,880	15,416	-2,768
March	2,592	84,888	6,080	72,960	11,928	-3,488
	84,888					11,928

NOTE: If when constructing the table (as was the case in this example), column F contains some negative values, then it means the correct month was not chosen to begin the calculations. The minimum storage volume can still be found by finding the largest negative number, changing it to a positive figure and adding it to the largest positive number in column F (SOPAC Manual, 2004). In this case the figures in column F denoted by asterisks were changed from -4,744 to 4,744 and from 19,512 to 24,256 respectively.

STEP 4: Use the volume capture and demand estimates to calculate the minimum storage needed (steps above). This calculation is best assembled using a spreadsheet. The data is contained in the table to the left.

The minimum storage required is the maximum value in column F minus the surplus water left at the end of the year. The surplus water in the tank is the final value in column F.
Minimum storage tank volume = 24,256 – 11,928 = 12,328 litres (2,711.79 gallons)

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