MINISTRY OF ECONOMIC GROWTH AND JOB CREATION

RAINWATER HARVESTING PLANNING GUIDELINE

OCTOBER 2023

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INTRODUCTION

The Caribbean Environmental Health Institute Handbook on Rainwater Harvesting for the Caribbean (2009) states the Caribbean region experiences a sub-tropical climate with eighty percent (80%) annual rainfall concentrated between May and December. In the Caribbean, rainfall varies, with larger, mountainous islands having higher accumulations. Rainfall ranges from 1,500mm to more than 3000mm per year, depending on the island size and topography. Rainwater Harvesting (RWH) was the primary water source before centralized conventional potable water supply systems and remains a low-cost option for meeting water supply shortfalls during dry months. RWH is a cost-effective solution for Caribbean water shortages, especially in the face of climate change, due to changing rainfall patterns and extreme storms.

Climate change threatens Jamaica's potable water supply, necessitating improved water storage, usage, efficiency, and conservation. Rainwater harvesting, particularly at the household level, can increase access to potable water, especially in areas lacking underground or surface water sources. Currently, fifteen percent (15%) of Jamaicans use rainwater harvesting as their primary water supply.

The National Water Sector Policy and Implementation Plan (NWSP) 2019 recognizes the use of rainwater harvesting as an important source of water supply. A key objective of the NWSP is to encourage rainwater harvesting, both as a primary source of access and as a drought management mechanism. The Policy measure for rainwater harvesting include the: (i) Promotion of rainwater harvesting for households in areas with adequate rainfall and where groundwater and surface sources are inadequate; and (ii) Promoting the rehabilitation and maintenance of community catchment tanks, where Municipal Corporations, Local Authorities, or the communities themselves wish to take on the responsibility of maintaining these systems. The NWSP also states that the Government of Jamaica (GOJ) will develop and adopt a Rainwater Harvesting Guideline.

What is Rainwater Harvesting?

Rainwater Harvesting is the diversion and collection of rainwater from impervious roof surfaces and storing it for later use is recommended for all new residential, commercial, institutional, industrial and office buildings to be constructed for the purposes of augmenting potable and non-potable water supply, as well as for existing buildings, where feasible.

Advantages of Rainwater Harvesting	Disadvantages of Rainwater Harvesting
1. Rainwater harvesting is a self-managed, owner-operated process that provides water at its required point.	Rainwater harvesting may not be a reliable source of water during prolonged droughts as it depends on the frequency and amount of rainfall.
2. It provides an essential reserve in times of emergency and/or breakdown of public water supply systems, particularly following natural disasters;	Rainwater harvesting volume is limited due to low storage capacity, which may hinder RWH systems from providing the necessary water during prolonged dry periods.
3. Rooftop rainwater catchment systems are simple to construct and can be customized to meet various requirements.	Cistern leakage can lead to the deterioration of load-bearing slopes that support the building foundation.
4. Households can start with a single small tank and add more when they can afford them;	Cisterns and storage tanks can be unsafe for small children if manholes (access points) are not adequately secured;
5. Installation of concrete cisterns as part of the building foundation can improve the structural integrity of the building substructure;	Water can become contaminated by animal waste (bird, bat, rodent droppings) and vegetable matter (rotting leaves, fruit);
6. The physical and chemical properties of rainwater are often superior to those of groundwater or surface waters;	Health risks may result where water treatment is not practiced prior to use (drinking);
7. Operating costs are low;	Cisterns and other storage facilities can be breeding grounds for mosquitoes where not adequately sealed;
8. The construction, operation, and maintenance does not have to be labour-intensive;	Rainwater harvesting systems can significantly increase home construction costs, especially for lower-income households, unless government subsidies are provided.
9. Reduces runoff	

(Source: 2009 CEHI Handbook on Rainwater Harvesting for the Caribbean by the Caribbean Environmental Health Institute)

System Design

The system design to be met for the implementation and operation of rainwater harvesting facilities are as follows:

1. Rainwater from roofs should be diverted and collected in gutters and channeled by way of downspouts to rain barrels, storage tanks, or cisterns. These should be dark-colored or buried to prevent algae growth. Rainwater can also be collected in small ditches under eaves and channeled into underground tanks by gravity. The former method offers better water quality and can be placed higher for easier tap system use and may eliminate the need for pumping. See diagram below of rainwater harvesting system components.

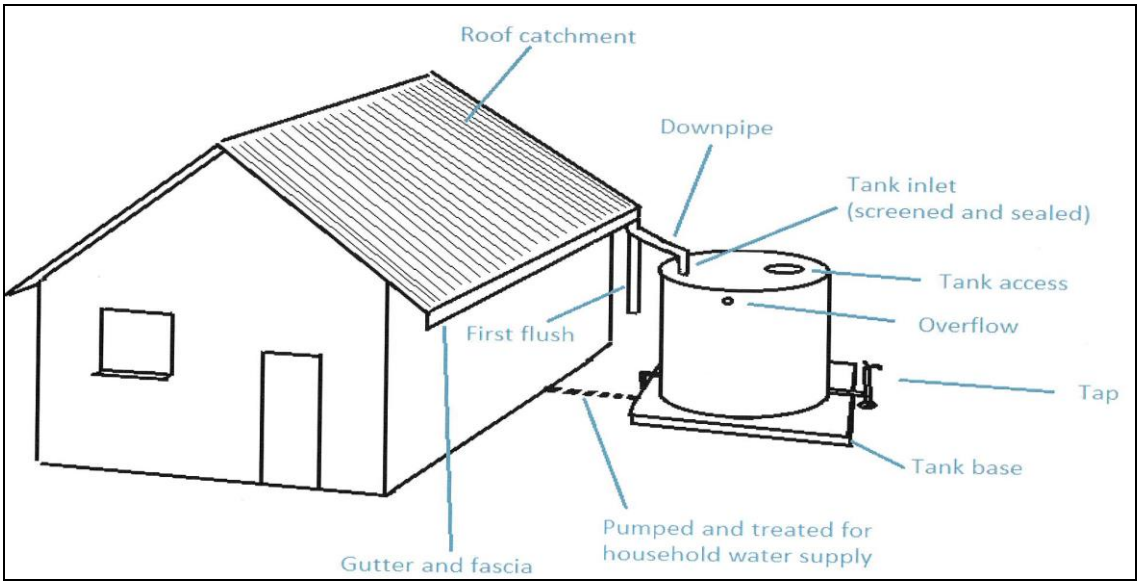

Diagram 1: Rainwater Harvesting System Components (IDB/UWI (2020) Rainwater Harvesting in the Caribbean: Rainwater Harvesting Manual)

2. A facility with water from a utility service provider must install a separate or dual plumbing system for indoor use, and pumps connected to cisterns, storage tanks, or rain barrels should not be connected to the public water main.

3. Stored rainwater may be filtered before being used for toilets and urinals flushing.

4. Stored rainwater to be used for potable (drinking and cooking) uses should be filtered and treated with chlorine bleach or boiling.

5. Pipes, berms, and contoured slopes can be used to direct rainwater to trees and landscaped areas.

6. Gutters leading to cisterns and/or storage tanks and /or rain barrels must have leaf screens typically of wire mesh with openings no larger than 1.27 centimeters (0.5 inches) across the entire length, including the downspout opening.

7. The first 45.5 liters or 10 gallons of roof runoff (first flush) during any rain event must be diverted away from cisterns storage tanks, or rain barrels, to landscaped areas, plants, drains or other locations approved by the local planning authority. This should be done by roof washers, where possible. The mechanism for the First Flush Assembly is at **Annex One (1)** for guidance.

8. Roof washers should contain 46 centimeters (18 inches) of sand, filter fabric and 15.25 centimeters (6 inches) of pea gravel to ensure proper filtration.

9. Cisterns, storage tanks, or rain barrels must be fitted with Reflux Valve (back-flow or non-return valve) to prevent water from back flowing into the public water main where available.

10. Except for single family residential developments, the pumps used for multi-family residential, office, commercial and industrial developments should have a backup pump and be capable of delivering not less than twice the minimum anticipated rate of water demand to the building. Solar energy pumps should be used wherever possible to reduce energy cost.

System Assembly Guidelines

The *Handbook on Rainwater Harvesting for the Caribbean (2009)* published by the Caribbean Environmental Health Institute and the United Nations Environment Programme will be adopted as a practical guideline for the construction of rainwater harvesting systems, subject to the copyright holders' rules for its use.

Operational Requirements

Inspections

The owners/operators should ensure that all elements (including backflow prevention systems) are inspected by a certified plumber or other relevant professional prior to being covered. Further inspection should be undertaken on an annual basis by the owner to replace treatment systems components such as filters and ultraviolet (UV) lights and to ensure correct functioning. Owners will be required to conduct inspections in areas where it is not possible for the Municipal Corporations to inspect.

Water Testing

Water to be used for potable purposes should be tested by the owner every six (6) months to verify quality, based on the Ministry of Health and Wellness' standards, which notes to make "rainwater safe'' it should be collected from surfaces that are clean, impervious, and free from debris, animal droppings, paints, and chemical residue. It should be filtered and disinfected with household chlorine bleach or boiled. Ozonation, Ultraviolet or reverse osmosis treatment modalities are suitable "**alternatives"**, which is preceded by a process of screening and filtration. The three alternative methods of treatment do not impart any residual properties as does chlorine products, hence; the risk of contamination after treatment is high. The treated water should be stored in water holding receptacles (plastic, concrete, stainless steel etc.) that are kept clean (every six months) and have pest exclusion and first flush diversion devices. The Ministry of Health and Wellness further recommends, Chlorine residual testing can be conducted by householders, farmers and commercial entities with the use of chlorine comparable test kits. Chlorine residual of 0.5mg/l or 5ppm is required. Bacteriological analysis for the presence of "indicator organisms and pathogens" can be done by certified laboratories.

Areas/Zones unsuitable for Potable Use of Rainwater

Areas/zones unsuitable for the potable use of harvested rainwater include industrial zones, agricultural areas, and communities in the proximity of dump sites (due to possible pollutants, heavy dust, soot, chemicals). In this regard, water collected from

rainfall in these areas/zones should not be used for potable purposes without extensive water treatment procedures, followed by regular (at least once monthly) testing.

Treatment Options and Standards

The following are guidelines for specific system assembly requirements and minimum standards to enable proper storage, treatment and use of rainwater for both indoor and outdoor uses.

Potable Indoor Use

- First flush diverter, cartridge filtration (3-micron sediment filter followed by 3 micron activated carbon filter).
- Disinfection by chlorine residual of 0.2 ppm or boiling.

Non-potable Indoor Use

- First flush diverter, cartridge filtration (5-micron sediment filter)
- Disinfection by chlorination with household bleach or UV disinfection optional.
- Purple (or a specific colour pipe) should be used to convey rainwater and should be accompanied by pipe stenciling and point-of-contact signage that indicate that the water is non potable and not for consumption.

Outdoor Use

- First flush diverter

Managing Water Quality

1.0 Disinfection by Boiling

- Boiling is the best way to kill potentially harmful agents without the use of chemical additives. It is recommended to boil the water for 3 minutes at 100°C.

2.0 Disinfection by Chlorinating

- Adding small quantities of chlorine to the water tank is the cheapest and most effective means of disinfection.
- Chlorine is an effective agent against most bacteria and viruses and provides residual protection. Instructions for disinfecting a rainwater storage tank using household bleach are detailed at 2.1.

2.1 Chlorine Disinfection Procedure

- It is crucial to carefully read and adhere to the safety and handling instructions provided on chlorine or bleach containers.
- Proper hand and eye protection should be worn when handling or preparing chlorine solutions to avoid burning skin and damaging eyes.
- Calculate the volume of water in your tank.
- Add ½ bottle (125 ml) of plain household-grade unscented and uncoloured bleach (with 4% active chlorine) to every 1,000 litres (220 gallons) of water currently in your tank. Different bleaches have different levels of active ingredient, which is usually marked on the container.
- Wait 24 hours after adding chlorine to water to disinfect it, as chlorine smell and taste will dissipate. If chlorine taste is unacceptable, boil water for 5 minutes before drinking. The amount of bleach to add, based on a 4% active ingredient.

Note Well: *The recommended bleach dosing is to add enough chlorine to create a free chlorine residual of 0.5 mg/l after 30 minutes, typically 5 mg/l. The residual can be tested using a swimming pool test kit or dip strips, available locally.*

(Source: 2009 CEHI Handbook on Rainwater Harvesting for the Caribbean by the Caribbean Environmental Health Institute)

First Flush Diverter

Please see the Caribbean Environmental Health Institute Diagram at **Annex 1** for a typical design and assembly of a First Flush Diverter. The materials required can be scaled for use for residential, commercial and institutional systems. It is recommended that it is cleaned annually, or as required.

Efficient Use During Rain Events

Collected rainwater should be used during rain events for necessary activities as much as possible to allow for simultaneous refill, thus ensuring maximum storage is achieved.

Roofing Materials

For potable use rainwater should be harvested from metal (including zinc and decra-tiles), wood shakes (shingle), concrete and clay roofs/roof tiles.

For non-potable use (such as watering of lawns/ landscape, washing down of pavements, etc.) rainwater may be harvested from fiber glass shingles, asphalt shingle or asphalt coated concrete roof.

Construction of Tanks

A tank provided for the storage of water shall be constructed of stone, concrete, galvanized iron, or thermoplastic polyethylene (black tanks). Tanks and other utensils used post catchment of rainwater shall have all openings screened to prevent the entry of mosquitoes.

Storage Capacity

Storage capacity will be dependent on the size of the development, available land space for establishment of the storage facility. The recommended minimum storage capacities are as follows:

Residential Use.....700 Gallons/3,150 litres

Commercial and Industrial Use.....1,500 Gallons/6,750 litres
Office Use.....1,000 Gallons/4,500 litres

Overflow from storage tanks, cisterns etc. should be channeled into existing drainage facility to the satisfaction of the local planning authority and/or the National Works Agency. This shall be the responsibility of the owner/user of the rainwater harvesting system.

Cleaning of Tanks

Tanks shall be cleared of sludge and properly cleaned a minimum of once every six (6) years, by the owner or responsible entity, where applicable.

Existing Rainwater Catchment/Harvesting Facilities

Where possible, existing rainwater catchment/harvesting facilities that do not conform with the conditions and standards outlined in this document should be upgraded to meet these requirements.

Rainwater Harvesting for Agriculture

Due to the specific water and other technical requirements for crops and livestock, the Rainwater Harvesting Planning Guideline will not be applicable for agricultural use.

Pictures Of Local Rainwater Harvesting Systems

Picture 1 & 2: St. Anns Bay Hospital Rainwater Harvesting System - St. Ann
(Courtesy of Rural Water Supply Limited)

Picture 3: Carron Hall Primary School Rainwater Harvesting System - St. Mary
(Courtesy of Rural Water Supply Limited)

Picture 4: Wood Hall Basic School Rainwater Harvesting System - Clarendon
(Courtesy of Rural Water Supply Limited)

Reference

CEHI (2009) ***Handbook on Rainwater Harvesting for the Caribbean*** The Caribbean Environmental Health Institute in collaboration with the United Nations Environment Programme available online at: http://www.caribbeanrainwaterharvestingtoolbox.com/Media/Print/RWH_handbook.pdf

IDB/UWI (2020) ***Rainwater Harvesting in the Caribbean: Rainwater Harvesting Manual*** University of the West Indies, Mona in collaboration with the Inter-American Development Bank