TE VAI TANIKA;

COOK ISLANDS - PA ENUA

RAINWATER HARVESTING AND MANAGEMENT

TRAINING MANUAL

Revision: 1

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Office of the Prime Minister
Government of the Cook Islands

DOCUMENT CONTROL

Revision	Comments	Prepared by	Date
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BACKGROUND

Climate change is brought about by changes in greenhouse gas concentrations in the atmosphere. This plus other drivers bring about a range of environmental and human health consequences. Environmental consequences of climate change include extreme heat waves, rising sea-levels, changes in precipitation, resulting in flooding and droughts, which indirectly the affects the physical, social, and psychological health of the Pa Enua residents.

Changes in precipitation are creating changes in the availability of water, with increasing uncertainty around rainfall and more extreme events. This is a matter of serious concern to the Island Governments of the Pa Enua.

Figure 1 below illustrates recorded rainfall data taken for the islands of Aitutaki, Penrhyn and Rarotonga from 1987 -2014.

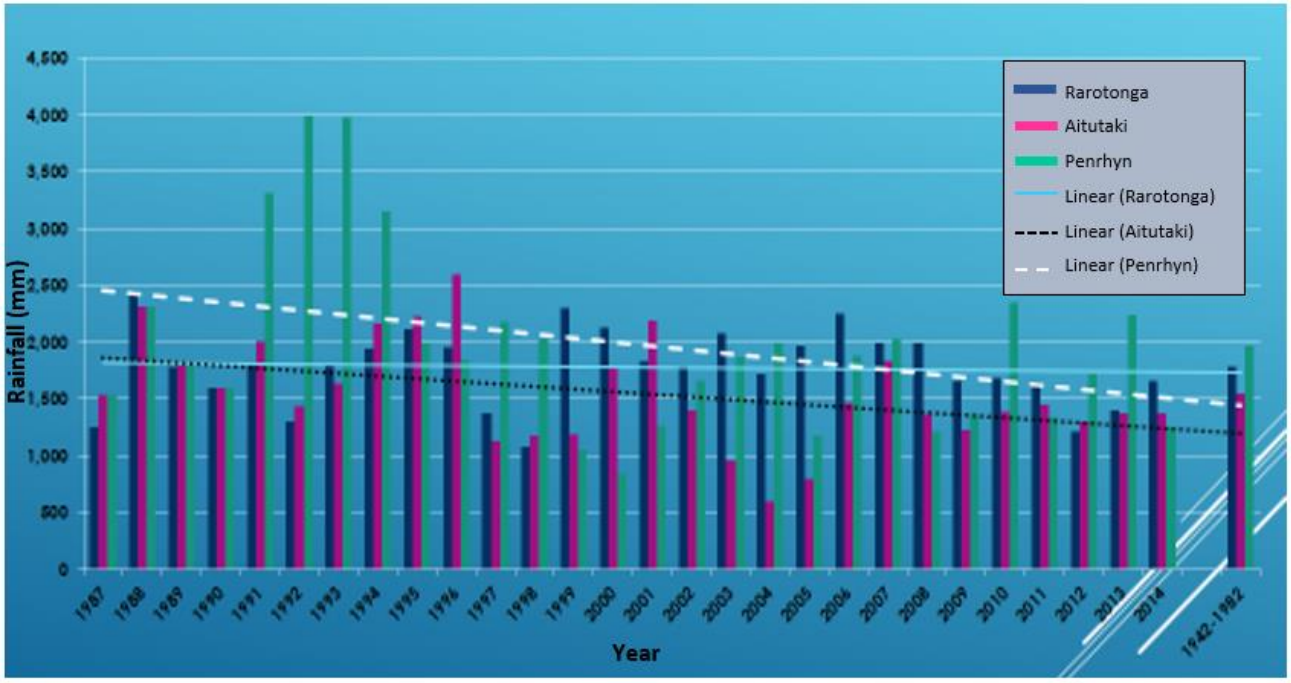


Figure 1. Recorded rainfall for Aituaki, Penrhyn and Rarotonga from 1987-2014

The data shows a declining average annual rain fall for all the 3 islands. This calls for renewed emphasize on whole island and community approach to water management. This is critical in order to manage drought and water shortage risks as well as associated elevated water borne health risks.

Rainwater harvesting systems are an important source of water for the islands, both at the community and household level.

The purpose of this manual is to assist the islands in the management of their rainwater harvesting systems, in order to improve the resilience of their water supply, in an attempt to minimize the risks of rainfall variability and climate change.

OVERVIEW

Te "VAI", a Rainwater Harvesting and Management Training Manual, has been developed for use by those working with the Pa Enua communities to understand the rainwater harvesting concept and help them implement rain water harvesting activities to improve water supply outcomes for their families and communities.

Te "VAI" provides background information and a range of practical activities to help stakeholders understand the components of rainwater harvesting systems (RWHS) in an effort to improve community awareness and provide skills on rainwater harvesting system operations, management and maintenance.

It includes a number of hand-outs and worksheets to facilitate training which are available in English and Maori with all trainer instructions provided in English.

Te "VAI" is primarily focused on community RWHS, but the topics covered and practical activities are equally applicable for household RWHS.

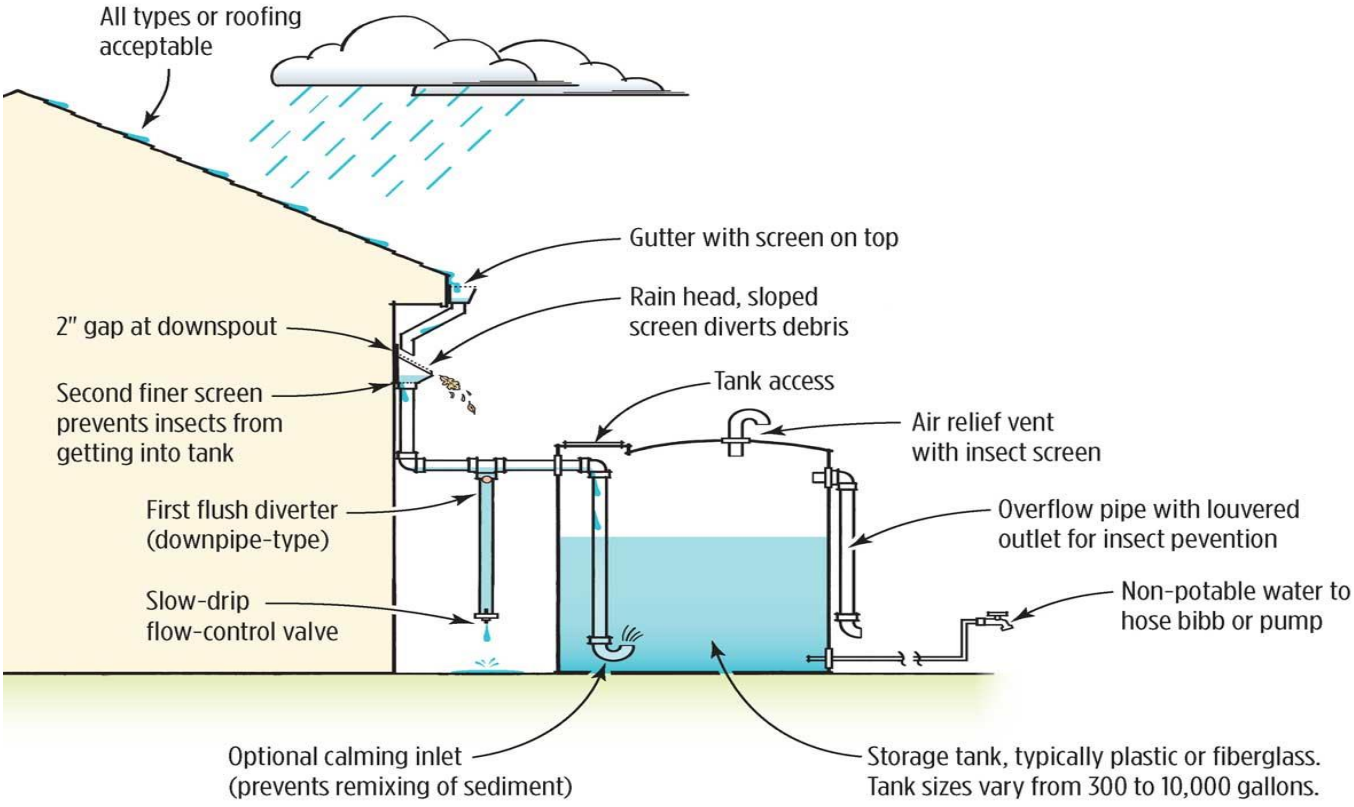


Figure 2. A typical rainwater harvesting system (Source: Google rainwater harvesting system)

THE TRAINING TOPICS

The training manual has seven sections:

Section 1: Water – Why is it important for you and me?

Section 2: The Water Cycle and Rainwater
This section introduces the water cycle and how rain is formed.

Section 3: Rain and Measuring Rainfall
This section tracks the rain when it falls from the sky to roof catchments. It highlights the variability of rainfall and how to measure rainfall.

Section 4: Typical Residential Rainwater Harvesting System in the Pa Enua, Cook Islands
This section provides an introduction to the rainwater harvesting system (RWHS). It has a technical focus on the purpose and function of the system components and key considerations for operation and maintenance.

Section 5: Community Water Tank Management and Monitoring
This topic encourages the community to consider how the community water tanks will be managed and monitored. They will consider what kind of management structure would work for them and who will be responsible for different tasks. The community management also encourages planning for periods of low water levels and droughts.

Section 6: Water Quality and Safety Planning
This topic identifies water quality risks and managing these risks. The activities aim to increase participant awareness on the potential pathways for contamination of water supply and emphasises the importance of maintenance to protect water quality and community health. Some guidance is also provided on treating water.

Section 7: Maintenance Checklist and Schedules
This section provides fact sheets and activities on maintenance of RWHS. This includes developing a maintenance checklist and schedule and linking these back to Section 5, community management.

Section 8: Water Management Best Practice
This topic summarises some of the key outcomes from the training manual and best management practices.

SECTION 1: WATER - WHY IS IT IMPORTANT FOR YOU AND ME?

A. Objectives

To understand the importance of water in our daily lives.

B. Practical Activities

1. Read the brief below

Water is a compound, with each water molecule made up of two atoms of hydrogen and one atom of oxygen bonded together, with the chemical formula H_2O. **Water** is the most important natural resource in the world. Without it, we humans wouldn't exist. We can't go for more than a few days without water.

Half of our bodies are made up of water. Blood is approximately 90% water and muscles approximately 75%. This liquid nourishes our body in the following way: It flows through the body, gives water and nutrients to each cell, and takes away waste from our bodies. It also provides the body with a cooling system by taking excreting heat through the skin, which eventually evaporates as sweat. It provides other important functions like making muscles move smoothly and helping your joints work for a longer period and maintenance of body temperature. It is also used by humans for cooking, bathing, washing clothes, brushing teeth, flushing toilets, **and most importantly it keeps us alive.**

2. Discuss the 3 states of water

Table 1 below provides some points participants should consider in their discussion.

Table 1. The 3 states of water

State	Description
Solid	• Water in its solid form is known as ice. • Water turns from a liquid to a solid by cooling the water below freezing point, or in scientific terms removing heat energy from the water. This process is known as freezing. • Water turns from a solid to a liquid by heating the water, or in scientific terms increasing the heat energy of the water. This processes is known as melting.
Liquid	• Water falls on the earth in liquid form as rain. • This is the only state humans can drink water. • It is necessary for every living being on this earth. • You drink water, cook with water, bath in water and do a whole lot more with water.
Gas	• Water changes from a liquid to a solid via a process known as evaporation. This occurs by increasing the temperature of the liquid to boiling point, or in scientific terms increasing the energy of the water molecules so the bonds between the molecules break. • Water from the surface of oceans, lakes and water tanks evaporates into the atmosphere into its gaseous state as water vapour. • When water vapour is cooled it transforms back into the liquid state. This process is known as condensation. • We can't drink water in its gaseous form.

Figure 3. Water in its liquid form - rain

SECTION 2: THE WATER CYCLE AND RAINWATER

A. Objectives

To understand the water cycle and how rain is formed.

B. Practical Activities.

1. **Break into groups**
2. **Discuss the following image (Figure 4)**
3. **Present back to the workshop**
4. **Describe the components of the water cycle in your own words**

Table 2 summaries the different components of the water cycle participants should consider.

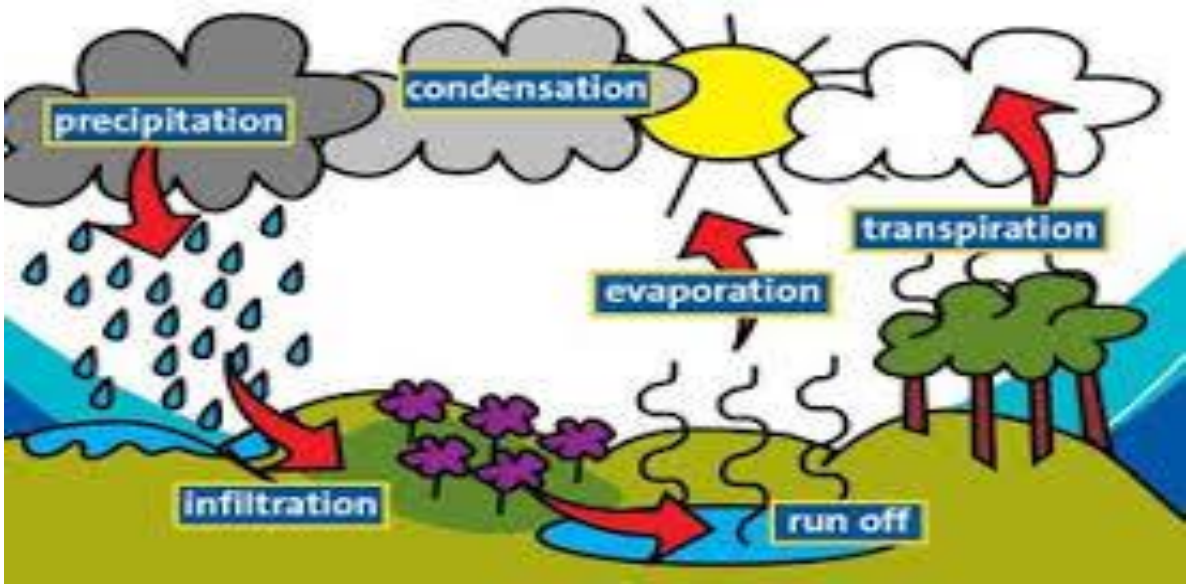


Figure 4. The Water Cycle (Source: Google NASA)

Table 2. Components of the water cycle

Process	Explanations
Evaporation	Water vapour rising from rivers, ground, streams lakes and the ocean into the atmosphere
Transpiration	Process where water moves through plants and the water vapor rises off the leaves, stems and flowers from trees and vegetation. Transpiration is the evaporation of water from plant leaves.
Condensation	Water vapour (gas state) changes into tiny water droplets (liquid state) which float in the air to form clouds.
Precipitation	When the tiny water droplets in clouds become large enough they will fall to the Earth under gravity as rain, snow or hail. This is precipitation. Water then flows into the streams, rivers and lakes and the ocean.
Infiltration	Water entering into the surface of the ground. Here it is stored in underground reservoirs known as aquifers.
Runoff	Once the infiltration limit of the ground is reached water flows over land and runs off slopes into streams, rivers, lakes and the ocean.

SECTION 3: RAIN AND MEASURING RAINFALL

A. Objectives

To understand what happens during times of rainfall and the variability of rainfall.

B. Practical Activities

1. **Break into groups**
2. **Discuss the following terms from the images below (Figure 5,**
3. **Figure 6 and Figure 7)**

- Raincloud
- Rain
- Roof
- Rain gauge
- Rainfall register
- Rainfall reading
- Total reading

4. **Present back to the workshop and discuss**

Table **3** provides some guidance on the terms discussed.

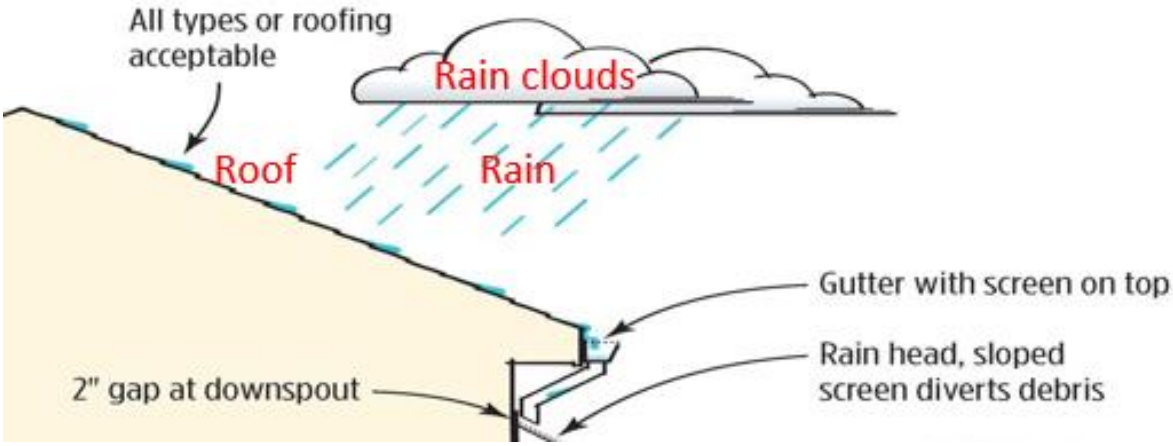


Figure 5. Rain falling onto a roof

Rainfall register

Rainfall reading

Total rainfall - monthly

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	4.2	3.8	28.2		0.0	0.0	0.6	36.6	0.0	0.0		
2	0.0	1.0	8.6	6.4	0.0	0.0	0.2	0.4	0.2	1.8		
3	0.0	1.6	3.6	0.4	13.0	0.1	0.4	1.0	0.6	0.2		
4	0.0	6.2	0.2		5.4		1.8	0.2	0.2	0.0		
5	0.0	12.8	3.6		0.2		0.6	8.0	0.0	6.0		
6	0.4	12.2	2.8	2.9	11.8	0.8	7.8	0.4	9.0	0.8		
7	4.4	46.8	1.2	0.2	30.0	1.4	0.6	0.4	12.2	0.0		
29	0.1		2.8	23.6	0.4	81.4	0.2	0.0	0.0			
30	1.6		13.4	4.0	0.1	40.0	0.2	0.0	0.0			
31	36.0		2.6				0.2	0.0				
TOTAL	**131.8**	**230.8**	**235.2**	**196.3**	**118.8**	**208.7**	**84.2**	**65.1**	**66.8**	**15.4**		
Running	**131.8**	**362.6**	**597.8**	**794.1**	**912.9**	**1121.6**	**1205.8**	**1270.9**	**1337.7**	**1353.1**		

Figure 6. Rainfall register

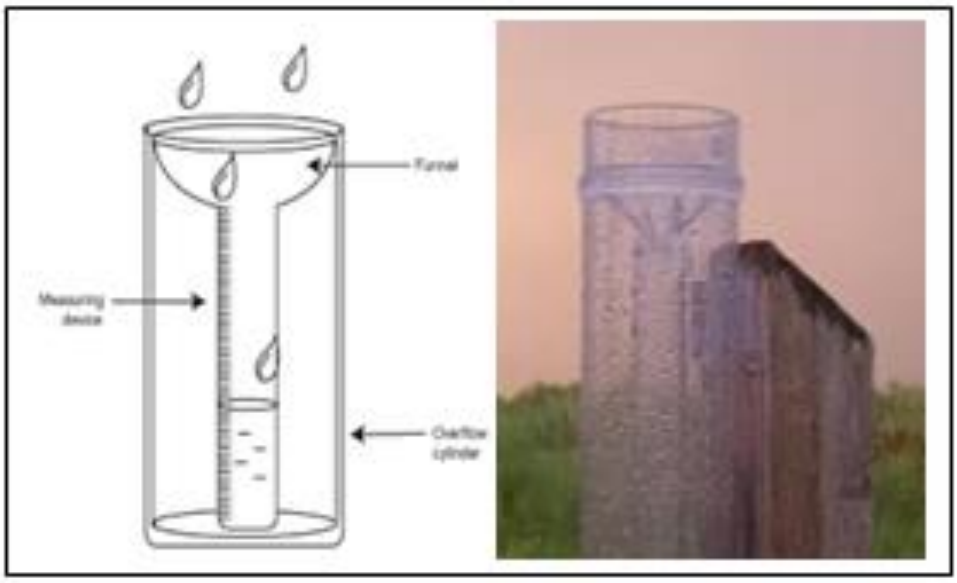


Figure 7. Rain gauge (source: google)

Table 3. Description and functions of terms relating to rain and measuring rainfall.

Concept	Description and Function
Catchment	
Raincloud	Water vapor condenses into tiny water droplets to form clouds. Once the water droplets get large and heavy enough precipitation occurs, where the water falls as rain (or hail or snow) to the ground.
Rain	• Rain falls onto the ground and into the sea • Consider what the risks of high and low rainfall are • When there is too much rain we have a flood situation • When there is not enough rain we have a dry and/or drought situation • The amount of rainfall is measured using tool called a rain gauge
Roof	• Roofs of buildings and houses catch the falling rain and channel it into collecting guttering. Where there is no guttering the rain runs down the roof and onto the ground. • We are able to collect water which falls on the roof and utilize it for our use • The size of the roof determines the amount of water we can collect. Catchment devices can be installed to help collect water and divert it into holding containers.
Measuring Rainfall	
Rain gauge	An instrument used for measuring the amount of rainfall. Rain water is collected in the gauge and the amount measured for a given period of time.
Rainfall reading	This is the reading taken from the rain gauge for a given period of time. In the rainfall register above (Figure 6) the readings are daily rainfall readings. The reading is entered into the rainfall register. Rainfall is usually measured in millimeters.
Rainfall Register	This is a collection of rainfall readings. It allows us to see trends and variability in the rainfall data.
Total reading	The total reading is the sum of the daily rainfall readings over a month and/or the year(s).

SECTION 4: TYPICAL RESIDENTIAL RAINWATER HARVESTING SYSTEM (RWHS) IN THE PA ENUA, COOK ISLANDS

A. Objectives

To familiarize participants with the concept of rainwater harvesting systems and for participants to understand the function of all of the components of the RWHS. This will help participants to understand why monitoring and maintenance is important and help them develop a maintenance checklist and schedule.

B. Practical Activities

1. **Visit a site with a rainwater harvesting system and map out the system components. Note each component from the roof to the bottom of the system, thinking about how the water flows through the system.**
2. **Identify and name of the parts of the system, what it does and its importance.**
3. **Note down which parts of the system need to be monitored, inspected and maintained, and what to look for during inspections.**

Use the images (Figure 8 and Figure 9) and Table 4 below to engage with participants.

Figure 8. A Typical Pa Enua Rainwater Harvesting System. This is in Palmerston

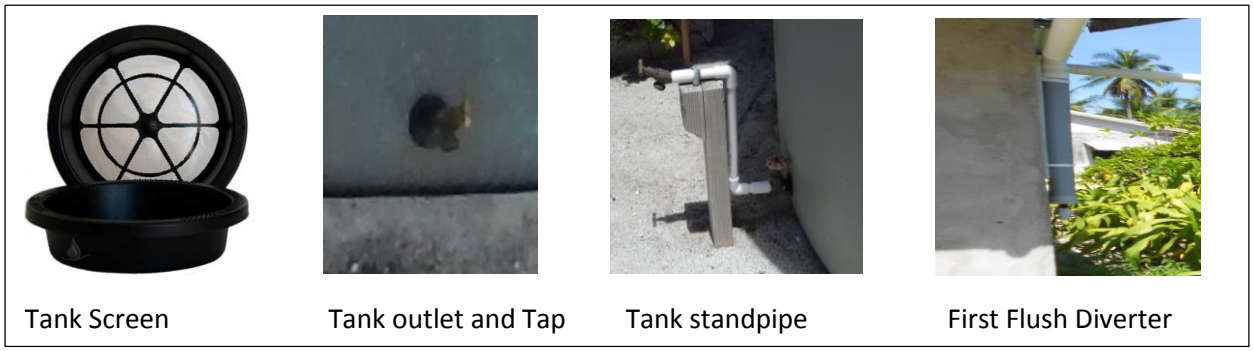


Figure 9. Some of the Typical Components in a Rainwater Harvesting System

Table 4. Components of a Typical Rainwater Harvesting System

Component	Discussion Points (description and function)
Rain	• Think about climate and drought • What does this mean for RWHS? • How much water is required each day? • How do we manage this demand when there is a drought? • What time of year do we need to think about conserving water? • How can we know if there is going to be rain or drought (e.g. warning from the Met office, Island Council, Raincloud tracking)
Roof	• Catches the rain • How is the roof area linked to the amount of water collected? • The bigger the roof and the more gutters, the more rain we can catch and therefore the more reliable the system • What other factors affect the amount of water available? (e.g. storage and usage) • How does the condition of the roof affect the water supply? • Factors to consider include; What is the condition of the roof? Is it clean? Are there any rust, holes, bid poo or overhanging trees?
Gutters	• Collects the water from the roof and transports it to the downpipes • Do gutters collect all the water from the roof? • What is the condition of the gutters? (A re they clean? Is there leaves or rubbish in them? Are there any leaks or rust? • Are the gutters installed properly? Is the end capped? A re they sloped towards the downpipes?
Down pipe	• Transports water from the gutters to the tank • Are the downpipes connected securely to the gutters and the tank? • Are there any leaks?
First flush	• The first flush is the initial runoff of a rainstorm • Water pollution is usually higher in the first flush part of the storm • The first flush is directed away from the tank to take the dirtier water away from the tank. • Are there any leaks in the device? • Is the device easy to check and use? • Is the cap at the bottom of the device on or off?

Filter screen	• Stops leaves and large particles entering the tanks, and stops mosquitoes breeding in the tank. • Is it covering the whole tank inlet opening- there should be no gaps. • Are there any tears or large holes? • Are there leaves and rubbish to remove?
Tanks Base	• Provides a firm, flat base for the tank so it is protected from sharp rocks and coral. • If the tap is directly from the tank, the base lifts the tank from the ground to allow easy collection. • Check for no large cracks or water eroding underneath. • Check the base is clean, especially if tap is directly from the tank.
Tank	• Holds the water and keeps it protected from contamination • The tank should be water tight and clean • The cover should be kept on and the tank cleaned when the water appears dirty • White King chlorine can be added to the tank to disinfect water
Tank level gauge	• Measures and monitors the water level in the tank. • Check gauge reading is measured correctly (confirm with manual measurement)
Outlet	• Connects the tank to the tap • When there are multiple tanks make sure the outlet valve is turned on so all the tanks can fill up.
Stop valve	• Controls the flow to the tap and other tanks • Can be used to isolate a tank such as during tank maintenance or maintenance of the tap
Overflow	• Takes water away from the tank when it is full • Can direct water to another tank or to a gravel soak pit in the ground
Fence (Optional)	• Controls access to facilities • Stops animals or children playing and causing damage
Tap stand	• Point of access for the community to collect water • Are there any leaks,or repairs needed? • Is the area clean, no puddles, and well drained?

SECTION 5: COMMUNITY WATER TANK MANAGEMENT AND MONITORING

5.1. Management of Community Water Tanks

A. Background

The Pa Enua have a number of community water tanks (example in Figure 10) built around big community and public buildings, to collect water for drinking purposes by the islands communities. There is a need to coordinate the use of these facilities and the water collected so that these are managed to efficiently meet the needs of all the stakeholders from the community.

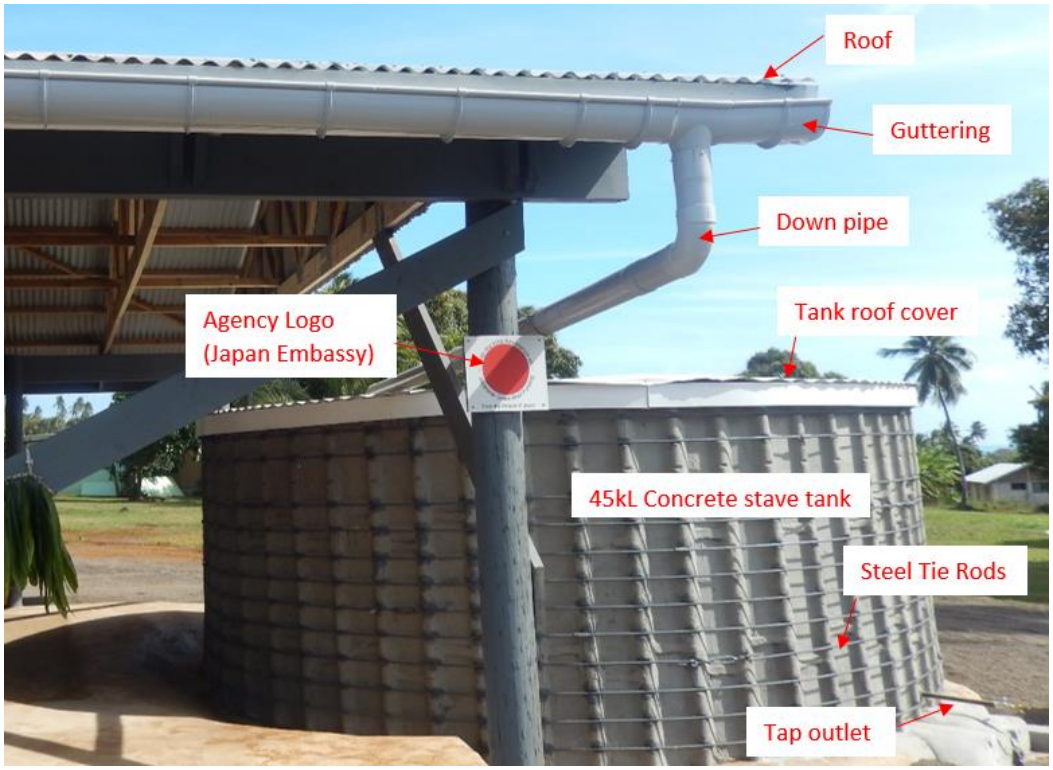


Figure 10. Typical Pa Enua Community 45kL Concrete Water Tank

B. Objectives

To encourage the community to appreciate their water supply systems and effectively manage and monitor these systems by considering the following;

- How these supply systems will be managed?
- What kind of management structure works for the community?
- Who will be responsible for the different tasks?

For this task it is encouraged participants consult with the community. This will enable them to form a committee including the various stakeholder groups to be part of the water management structure.

C. Practical Activities

1. **Split in groups and take notes and discuss the following questions;**
    - What are the different ways of forming a water committee?
    - How does the community select other committee groups? e.g. school and church groups
    - How do you involve other parts of the community?
    - How can resources and funds be raised?
2. **Present back to the wider group**
3. **Complete the following two tables below with community groups**

    Note down ideas on the questions in Table 5 below.

Table 5. Community Management Deliberations

Should the Island establish a Water Management Committee?
Which Community groups should have a representative on the Water Management Committee?
How would you involve different parts of the community, including men, women and youth?
Who should be the office bearers of the committee? e.g. Chairperson, Secretary, Treasurer

Do you agree or disagree with the following suggestions in Table 6?

Table 6. Community Management Committee Composition

The Committee should compose of the following people:	Agree	Disagree
Member of Parliament		
The Mayor		
Rep of Island Councilors		
Island Government Executive Officer		
Public Health Officer		
Rep of RAC		
Rep from Women group		
Rep from Youth Group		
Others?		
Do you agree or disagree the Committee should have the following responsibilities?	**Agree**	**Disagree**
Make recommendation to the Island Council on management of the island water resources and future water development opportunities.		
Consult with the Island Government and National Government to develop a management system for water and water infrastructure assets, including maintenance and replacement.		
Plan and design water use database collection. Determine who will collect and store the data.		
Make recommendation to the Island Council to include the refurbished water infrastructure as part of the Island Government asset register.		
Make rules on how the water can be used.		
Undertake regular checks to make sure the water supply infrastructure is in good condition		
Develop a plan for action in the event of drought.		
Keep the community well informed on issues related to rainwater systems.		
Resolve any conflicts which may arise in the community in relation to the water use.		

5.2. Monitoring Tank Water Levels

A. Objectives

To educate participants on how to check the tank water level and how to develop an action plan for water management.

B. Practical Activities

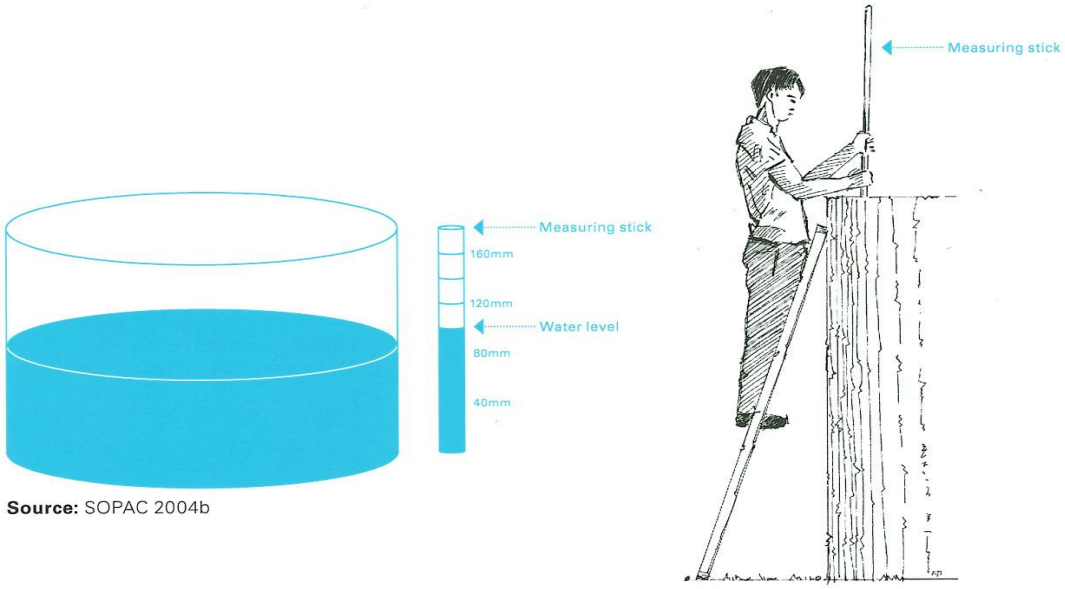
1. Read and discuss the following information on how to measure the water level in different types of water tanks.

Plastic or PE Tanks **(**Residential and Community**):**

1. Start from the bottom of the tank, tap the side of the tank and listen to the sound
2. When the sound changes it indicates the water level
3. Record this water level

Concrete tanks (Residential and Community):

1. Take long dry stick
2. Put the stick through the covering until it reaches the bottom of the tank (Figure 11).
3. Remove the stick
4. Use a ruler or tape to measure the length of the wet part of the stick in centimeters and record measurement



Source: SOPAC 2004b

Figure 11. Method for measuring the water level in a concrete tank. (Source: SOPAC)

2. Develop an action plan using the table below.

Get participants to fill in the table and discuss.

Table 7. Water action plan

Water tank level	Action	Person Responsible
Full	No Action	
¾ full	Make note near tap so user knows the level	
Half full	Make note near tap so user knows the level and ask council for climate forecasts	
¼ full	Control water use by introducing opening restrictions	
Empty	?	

3. Consider how you would work out the water levels and water availability in the community

Participants should consider the table below and how you would go about getting the following information on water in the community.

Table 8. Water Tank Information

Household	Tank Volume - Residential (L)	Tank Volume - Community (L)	Water level	Current Volume (L)	Comment
1	6000		3/4	4000	good
2	6000		1/2	3000	Take note
3	10000		Full	10000	good
4	6000		Full	6000	good
5	6000		Empty	0	**Check = F**
6	6000		1/2	3000	Take note
7	6000		1/2	3000	Take note
8	6000		Empty	0	Check
9	6000		1/2	3000	
10	6000		1/2	3000	
11		20,000	1/4	5,000	Take note
12		40,000	1/4	10,000	Take note
Total	**64,000 = A**	**60,000 =B**		**50,000 =D**	
	124,000 =C			50/124=E (40%)	Below ½ of total capacity

A= the total water holding capacity in homes from residential tanks

B= the total water holding capacity in the community tanks

C= the combined (residential and community) water holding capacity of the whole community

D= is the total amount of water contained in all the tanks in the community at the time of measuring

E = the proportion of the water in the tanks relative to the total storage capacity at the time of measuring

F= Instruction to see why the tank is empty

4. Discuss and note down the factors to consider when tanks are empty

When there is no water in the existing tanks it is in the interest of the resident and community to find out why this is so. The things to check include (see the RWHS mapping in Section 4):

- Roof - Is it leaking, damaged or rusty?
- Guttering - Is it connected properly to the roof? Does it have a hole in it?
- Down pipes - Are they connected properly to the guttering? Are they draining into the tank
- Tank - Is it leaking and is there water draining out of the tank
- Taps – Are they leaking?
- Has it been raining?

SECTION 6: WATER QUALITY AND SAFETY PLANNING

A. Background

Water while being harvested and stored in tanks can become contaminated in a number of ways. These make the water unsuitable for drinking and pose a health risk to the community.

B. Objectives

- To understand that water can be contaminated if the systems are not monitored and not maintained sufficiently.
- To understand the options for disinfecting water supply

C. Practical Activities

1. **Make a group site visit to observe an existing community water tank**
2. **Get participants to make a list of the ways water can be contaminated**

   These could include:

   - Dirt and faeces
   - Dusts, leaves and debris
   - Animals – insects, rats, birds
   - Breeding mosquitoes
   - Dirty containers and nappies

3. **Discuss and list how we can keep the water free of contamination**

   - Split into groups and get participants to note down and discuss ideas
   - Give out fact sheets below and read through them

4. **Talk through options for water treatment**

   Discussion should include the following:

   - Boiling water
   - Bleaching tanks
   - Solar Disinfection (SODIS) – Disinfection water using solar energy

D. Fact Sheets

HOW CAN WE MAKE THE WATER SAFER?

- Clean the roof
- Cut back any trees hanging over the roof. Consider what to do if you can't do this.
- Screen all openings to prevent mosquitoes and animals (e.g. rats and geckos) entering the tank.
- The tank must be sealed and dark to prevent growth of algae and prevent animals entering the tank
- Fill any cracks in the tank
- Tanks, gutters and other system components should be inspected and cleaned regularly
- Water should not be consumed directly from the tank without treatment
- Water from other sources should not be mixed into the tank
- Use taps to take the water from the tank. Do not use buckets to take directly from the tanks
- Put a fence around the tank and the tap to stop animals and vandals
- Treat the water if contamination is suspected through boiling, SODIS, chlorine (White King)

SANITARY SUVERYS

Use these forms to review the safety of your rainwater harvesting systems annually.

Table 9. Water Collection Survey

Question	Answer (Yes/No)	Why is it a problem?	How to fix it
Is the roof or guttering dirty?		• Leaves, branches on the roof area are washed in the tank, rotting and adding sediments and causing bad tastes • Dirt and faeces from birds and rats can contaminate the water and cause sickness	• Clean the roof and gutters • Use first flush diverters • Clean tank • Treat water before drinking
Are trees overhanging the roof?		Trees give pest access to the roof and guttering allowing dirt and faeces to enter the tanks and contaminate the water with disease.	• Cut back tress • Clean tank • Treat water before drinking
Is the roof or guttering in poor condition? E.g. rust on the roof, gutters broken or came off the fascia board etc.		Rust particles and paint can be washed into the tanks causing chemical contamination of the water and affecting the taste of the water.	• Clean roof and gutters • Repair roof, gutters and down pipes • Clean tank • Treat water before drinking
Does the rainfall amount change throughout the year?		Water in the tanks will eventually run out during dry periods so we need to ensure the tanks are topped up when there is rain.	• Monitor tank water levels • Manage water use when water level is low • Encourage water conservation • Add additional tanks

Table 10. Water Storage and Use

Question	Answer (Yes/No)	Why is it a problem?	How to fix it
Has the tank been empty before?		Not enough water for the household and community	• Monitor water levels • Manage water when water tank levels are low • Consider alternative water sources • Add additional tanks
Is it more than 12 months since the tank was last cleaned?		Sediments in the tanks can cause contamination and sickness	• Clean tank • Disinfect tank with bleach • Boil/treat water before drinking
Are there any entry points to the tanks? E.g. lid off and unscrewed over flows		• Dirt, leaves and pests can enter the tank through these areas and contaminate the water • Mosquitoes can also enter and breed in the tanks	• Place lid on the tank properly • Place screens over the water inlet and over the overflow pipe
Does water pond around the tank?		This can encourage the breeding of mosquitoes	Fill the surrounding area with silt and gravel to avoid ponding of water around the tank
Is water collected and stored in dirty containers?		Containers can contaminate clean tank water and cause sickness	• Always use clean containers to collect and store water • Use designated containers only for drinking water
Is the water consumed without treatment?		Water may be contaminated and cause sickness	• Treat water before drinking • Keep tank and roof well maintained • Use clean containers

Table 11. Community Capacity and Behavior

Question	Answer (Yes/No)	Why is it a problem?	How to fix it
Do people looking after the water have any training?		The system could break down and not be fixed properly.	Seek help and advice from technicians and others who have experience and training in water supply systems
Are there the correct tools and spare parts to maintain the system available?		System cannot be repaired properly	• Community funding for spare parts • Seek assistance from Island Governments
Are there instructions for maintenance of the system?		The system could break down and not be fixed properly	• Seek help and advice from technicians and others who understand and have training in how to maintain water supply systems
Is there someone who knows how to look after the system?		If this person is not available then the maintenance can't be carried out	Have 2 or more people trained and responsible for maintenance of the system

DISINFECTION OF WATER TANKS

After using your water tank for over a year it is necessary to disinfect it. Disinfection refers to undertaking practical activities to remove potential contaminants from the tank. This should be done every year or when:

- Someone is sick from drinking water from the tank
- Animal or bird wastes have entered the tank
- Bird or rats have drowned and died in the tank
- Water has been tested to have contaminants in it
- Someone has gone into the tank to repair and clean it

Table 12 outlines the steps to disinfection your water tank using bleach.

Table 12. Steps to disinfect water tanks with bleach.

Steps	Activity	Bleach
Step 1	Estimate the water level in the tank	
Step 2	• Add 125ml of bleach for every 1000L of water in the tank. This is based on using bleach with 4% active chlorine. Make sure the bleach is unscented Mix water with bleach	
Step 3	• Leave tank lid open to allow chlorine to evaporate • Wait 24 hours before drinking the water	

Bleach comes in a range of brands in 750ml bottles. Make sure you use regular unscented brands. The Table 13 shows how much bleach to add for the volume of water in your tank

Table 13. Ratio of bleach to water for disinfecting water tanks (based on bleach with 4% active chlorine).

Volume of water in the tank (L)	Amount of bleach (ml)
1000	125
2000	250
3000	375
4000	500
5000	625
6000	750 (1 bottle)

SECTION 7: MAINTENANCE CHECKLIST AND SCHEDULES

A. Background

Water tanks and buildings, like cars, wear down over their life cycle so it is important to maintain these over time to ensure they continue to function and work when required. RWHS require maintenance to minimize their wear and tear.

B. Objectives

To develop a maintenance check list and schedule for rainwater harvesting systems and assign people to be responsible for these.

C. Practical Activities

1. **Revisit the map of the rainwater harvesting system components developed in Section 4**
2. **Set up a schedule inspection program using Table 14 below**

Table 14. Rainwater Harvesting Schedule Inspection Program

Section	Task / Inspection	When	Who
Roof			
Gutters			
Down pipe			
First flush			
Filter screen			
Tanks Base			
Tank			
Outlet			
Overflow			
Tap stand			
Steel Tie rods			

SECTION 8: WATER MANAGEMENT BEST PRACTICE

A. Objectives

To identify best practices for managing RWHS and summaries the key points discussed in this training manual.

B. Practical Activities

1. Discuss the following.

The success of the RWHS is dependent on the following items identified in Table 15.

Table 15. RWHS Best Practice Guidelines.

Item	Discussion Points
Water catchment (roof)	• Roof materials in good condition • Clean and free of debris • Adequately guttered to collect all captured rain • Guttering joints well connected • Spouting well connected • Relevant dirt catcher or first flush diverters
Water tanks	• In good condition • With relevant overflows • Installed taps positioned at the right distance from bottom • Suitable base • Inlet pipe installed properly
Water	• The water should be clear • This should be boiled if required
Maintenance and Monitoring	• Both conducted regularly • Maintenance conducted during water level monitoring exercise • Defects reported • Defects repaired

REFERENCES

1. Mosely Luke -, SOPAC Miscellaneous Report 579
2. SOPAC- Guideline for rainwater Harvesting in Pacific Island Countries
3. GHD Pty Limited- Kiribati Rain water harvesting Management Training Manual