TOOLKIT

COMMUNITY WATER

A COMMUNITY BASED WATER MONITORING TOOLKIT USING THE H_2S PAPER STRIP TEST

Prepared for the Ministry of Environment, Energy & Water
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Male', Maldives November 2006

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COMMUNITY WATER

AGENDA

COMMUNITY WATER TOOLKIT

SESSION 1: (2 HOURS)

1. Welcome & participant introductions (15 minutes)
2. How does the program work: The H_2S toolkit training programs and objectives (15 minutes)
3. Discussion of situation portrayed in the cartoon (30 minutes)
4. Introduction to the H_2S toolkit and how it works (30 minutes)
5. How to do samples and fill the recording form (Form 1) (30 minutes)

Refreshments

SESSION 2: (1.5 HOURS)

6. Activity – How clean is our water (Take water samples and fill the record form).

SESSION 3: (1.5 HOURS)

7. Activity: Water and health. (30 minutes)
8. Activity: Community Timeline. (1 hour)
9. Introduction of the Hygiene survey and how it works. Select sites / households to conduct hygiene survey. (1 hour)

Refreshments

SESSION 4 (PRACTICAL): (2 HOURS)

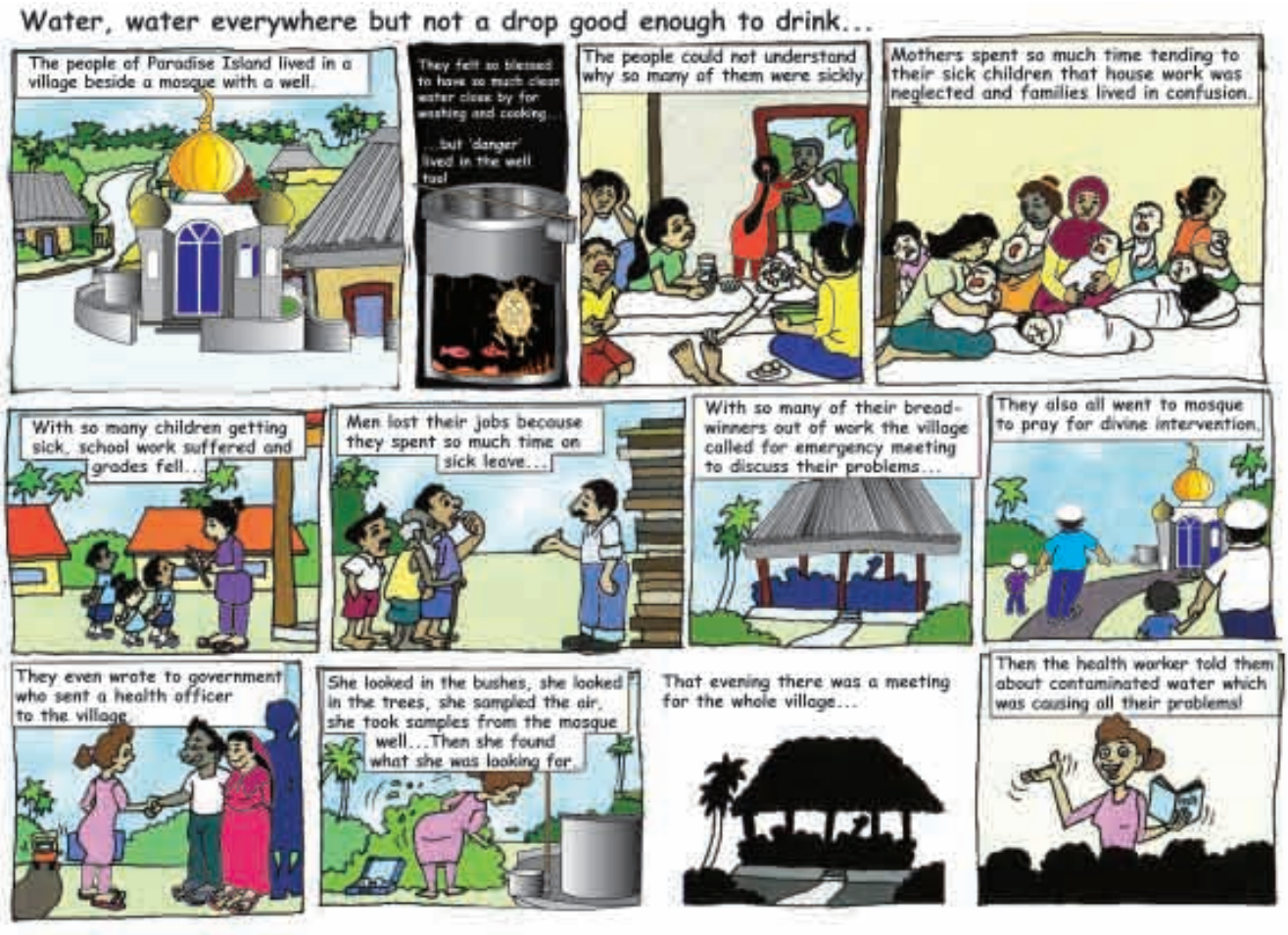
10. Conduct hygiene survey and record results on the survey form.
    Take water samples and fill the record form (Form 1).

SESSION 5: (2 HOURS)

11. Analyse the results of H_2S toolkit test results (30 minutes)
12. Analyse the hygiene survey results (30 minutes)
13. Activity: Taking action (50 minutes)
14. Conclusion & Evaluation: Review of course outcomes & evaluation (10 minutes)

Refreshments

The first step towards getting somewhere is to decide that you are not going to stay where you are



This Community Water Toolkit has been prepared for you to help you increase awareness and action in your community towards developing the important relationship between "healthy water and healthy people".

The Community Water Toolkit looks at the role we play in making sure that our drinking water is safe to drink and how we can manage our water resources better.

COMMUNITY PARTICIPATION

Schools, teachers, health educators and community members can use this toolkit to promote safe sanitation, hygiene and health in their communities.

The Hydrogen Sulphide (H_2S) Paper Strip Test is a major part of this toolkit.

You can use this H_2S Paper Strip test to regularly monitor the quality of your water supply and mobilize community action.

The H_2S Paper Strip Test was first used in India to test for coliform or bacterial contamination in potable water. Since then it has been used by many more communities globally and in the Maldives.

Water testing can alert a community to contaminants in time to prevent health problems!

But conventional methods of testing require sophisticated laboratories, highly trained technicians, and expensive supplies - most of which are not easily accessed by resource poor communities or unavailable in isolated communities.

The advantage of the H_2S Paper Strip test is that it is low-cost, does not require samples to be shipped or refrigerated, it does not require a laboratory or expensive equipment, and most importantly, it is easy to understand and carry out in field!

The Water Monitoring toolkit provides you with an Activity Guide to help you to facilitate the use of the H_2S Paper Strip Test in your communities and develop a work plan for community action to address water issues. It also includes a few materials and tips to help you as a community educator.

H_2S Sample bottles

The well should be cleaned regularly!

Participation, Awareness, Action!

World Health Organisation estimates that in developing countries, 25,000 people per day die from diseases carried by dirty water!

THE TOOLKIT CONTAINS:

- An Activity Guide with tools to help you address water issues in your community and facilitate the use of the H_2S test and sanitary survey.
- User-friendly instructions on how to use the H_2S Test to monitor drinking water quality.
- A Recording Result sheet, sanitary survey sheet, awareness comic guide and test bottles.

Go through the toolkit thoroughly before you begin working with your community group. We hope that this Toolkit will be useful in motivating communities to monitor drinking water sources and promote better sanitation, hygiene and access to safe drinking water.

Good luck!

IMPORTANT BACKGROUND INFORMATION FOR YOU!

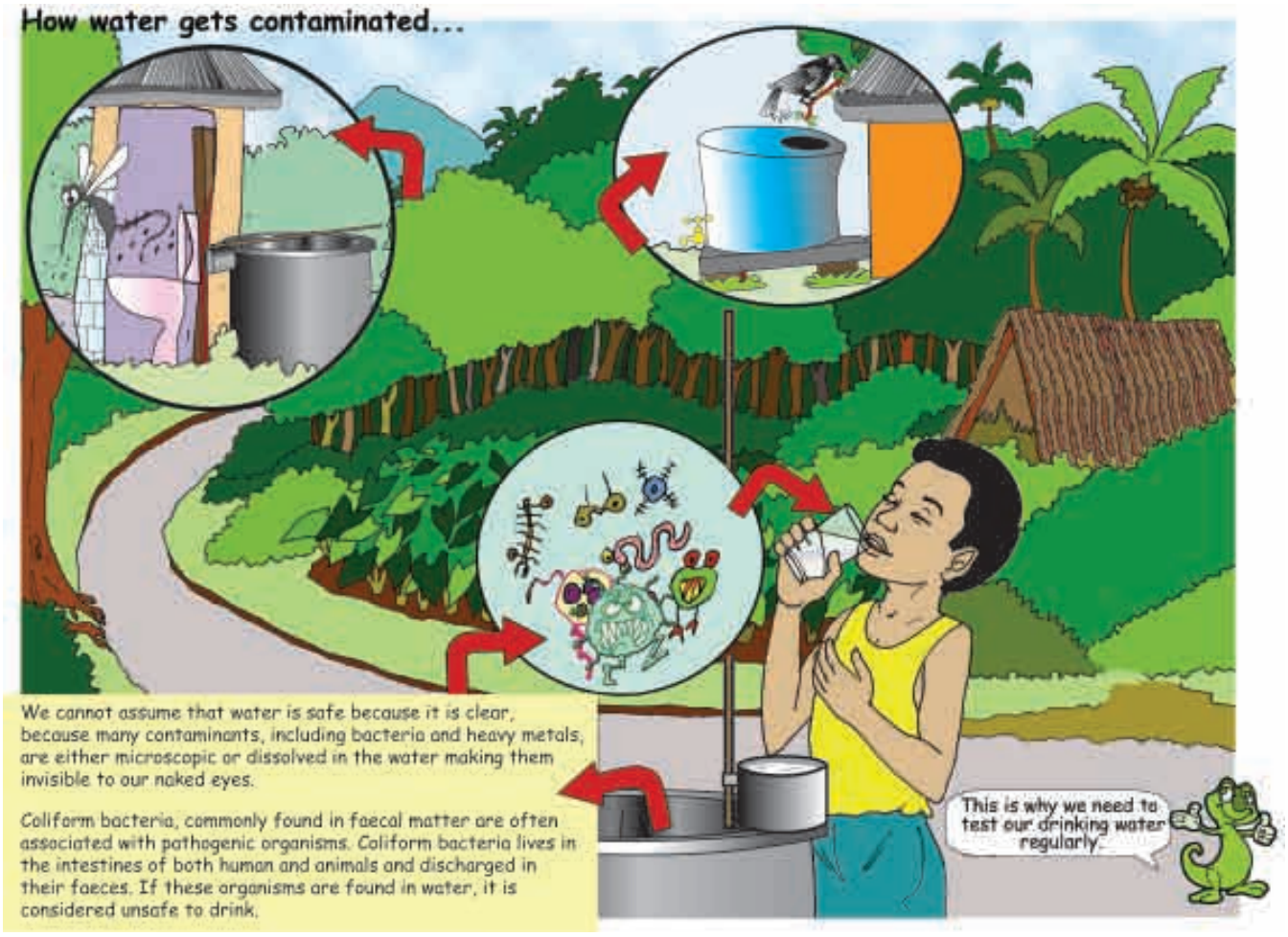
Why clean water?

Water is essential for all life. A few organisms can survive without air, but none can live without water. The quality of water can affect the life of people, plants and animals because all depend on water for survival.

Clean, fresh, safe water is essential for our health and in our day to day living. Equally important is having access to adequate sanitation and hygiene. The World Health Organization estimates that 80 percent of all sickness and disease is a result of inadequate water and sanitation and 2.2 million people, mostly children, die from diarrhoea every year in developing countries.

That's about 25,000 people per day who die from diseases carried by dirty water!

Many people in developing countries know that the best way to avoid diarrhoea is by boiling water before use, yet in many areas of the developing world a lack of firewood and time means water is rarely boiled.



Why test our water?

Unfortunately, pollution in water is sometimes difficult to detect. You cannot assume that water is safe just because it is clear.

Water that is odourless and clear is not necessarily free from contaminants or pollutants. If drinking water is untreated or improperly treated it may contain micro-organisms (bacteria) that can cause the spread of water-related diseases like diarrhoea, typhoid and cholera.

There are many types of micro-organisms on earth. Some are helpful to humans, but others can cause people to become sick. These organisms are so small (microscopic that is) we cannot see them, unless we use a microscope.

Why we need to test our drinking water?

Coliform Bacteria...

lives in the intestines of both humans...

and animals.

The bacteria is discharged...

through faeces into well water...

and if the water is drunk...

that person becomes infected too and may contact serious health problems.

When do we need to test our drinking water?

Whenever we get our water from wells, water tanks or any other source other than a government monitored water treatment plant, the water...

needs to be treated

or tested...

The water may look clean...

but it is in fact contaminated by dangerous bacteria including the coliform type which can cause the spread of water-related diseases like diarrhoes, typhoid and many more.

Is drinking untreated water the only way to get water- borne disease?

Water that is untreated, or not properly treated is not the only way water can get contaminated or we can get water- borne diseases. Other ways like collection, storage and handling of food, the disposal of excreta and the care of children can cause diseases. It is a common belief that children's faeces are harmless, whereas in fact they are the main source of infection to other children (WHO, 1997).

Simple practices like washing of hands after visiting the toilet, good disposal of water and excreta, covering of food and boiling drinking water can help to protect us from water- borne diseases like typhoid and diarrhoea and can prevent the contamination of water.

COMMUNITY ACTION: "HEALTHY WATER- HEALTHY PEOPLE"

Awareness and action towards clean drinking water at community level is critical in improving health and quality of living. Protecting water sources from pollution and maintaining the high quality of water supplies plays a critical role in efforts to protect the health of people, ensure a good quality of life and provide for sustainable development.

This process starts with investigating water quality in your community and thinking about ways to prevent pollution and improve your water source.

It is important to learn about the situation in your community- where the water supply is coming from, how safe it is, what it is being used for, how it is being polluted or wasted, and what you can do to prevent pollution and conserve water.

By being better informed, you will be able to participate actively in decisions concerning the use and management of your water resources. You can motivate your community to plan and take action to protect your health and the environment.

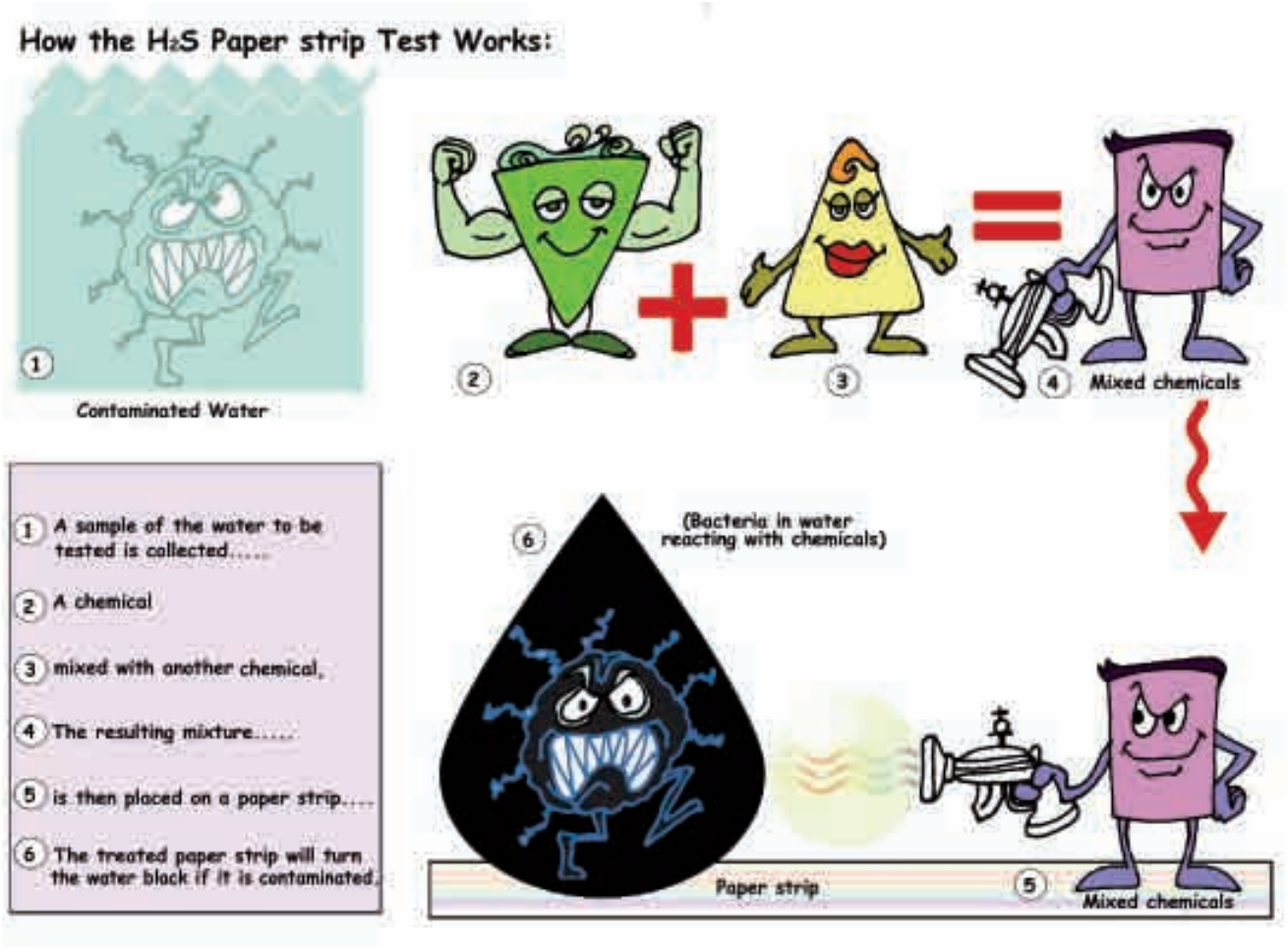
HOW DOES THE H_2S PAPER STRIP TEST WORK?

The Hydrogen Sulphide- H_2S Paper Strip Test uses a paper strip to check for coliform or bacterial contamination in drinking water sources.

Coliform bacteria produce a gas called hydrogen sulphide (this is the gas that smells like rotten eggs).

In order to check for the presence of coliform bacteria in water, a water sample is filled into the test bottle with the paper strip. Chemicals have been mixed into a solution and placed on the paper strip. The paper strip will react with the water sample by turning black if it comes into contact with hydrogen sulphide.

If the water sample or paper-strip turns black, this indicates that hydrogen sulphide was produced. This means that it is likely that bacteria of faecal origin are present in the water- that is, the water has been contaminated with animal or human waste.



WHAT CAN WE USE THE H_2S TEST FOR?

1. For monitoring of island water supply systems where it may be difficult to conduct conventional testing due to isolation or a lack of appropriate laboratory facilities.
2. For routine monitoring of reticulated systems; i.e. water that is distributed through a piped system.
3. If a positive result is observed, another sample can be collected for further analysis in the laboratory.
4. To determine the cleanliness of water storage tanks and other household storage containers.

How well-protected is the well

5. To identify sources of contamination or the point in a piped system where bacteria may be entering the water source.
6. To check how effective you have been in disinfecting a water source, or to verify that a well has been properly protected.
7. As a tool in health and hygiene education to show people how water becomes contaminated and what they can do about it.
8. For monitoring during emergencies and disasters such as cyclones when water- borne diseases are more likely to occur and conventional testing is difficult.
9. To demonstrate how easily hands become contaminated and how easily they can contaminate food and water. For example, it can be used to demonstrate the effectiveness of washing hand with soap; i.e. to illustrate how faecal bacteria can get from the hands to the mouth and into the body. This is done by pouring clean (boiled and cooled) water over unwashed hands and testing it, and having others wash their hands with soap and repeating the exercise.

Water storage containers-Are they safe?

Did you know....?

Waterborne diseases are spread through the drinking of contaminated water and food. About 80 percent (80%) of all diseases are water-related.

In many cases, sewage gets into the water and spreads disease. Also an infected person or animal may pass pathogenic bacteria, viruses, or protozoa through their waste into the water.

Because these micro-organisms that cause illness often cannot be seen, smelled or tasted, contaminated water can appear fresh and clean. This is a concern because contaminations often go unnoticed until people start seeing the doctor complaining of diarrhoea and other water related diseases.

The H_2S Paper Strip Test!

INSTRUCTION GUIDE

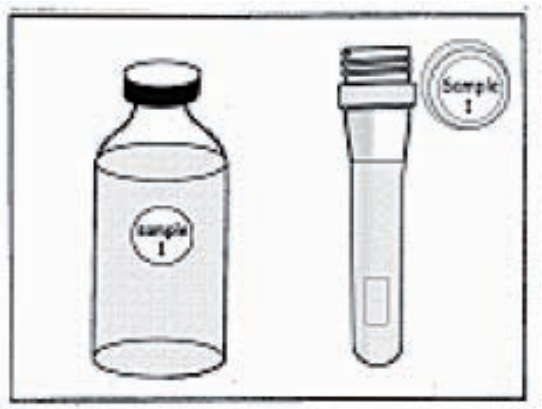
For Water Monitors!

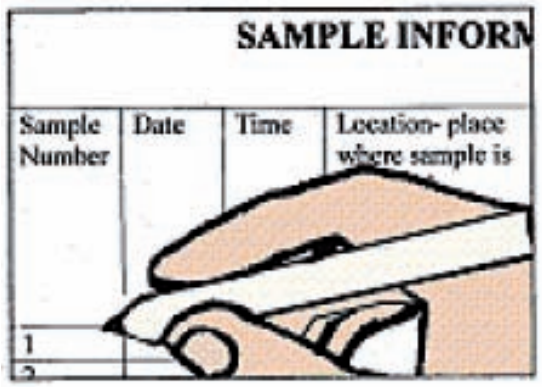
HOW DO WE CARRY OUT THE H_2S PAPER STRIP TEST?

STEP 1

FILL IN THE DETAILS

- Fill in Sample number and date on the round sticker or sticker strip label and stick on the sample bottle. Be careful not to get the sticker wet!
- Record your Sample number, date, time, location and description of the water sampled on the Result Record Sheet.
- Record any other information e.g. turbidity, smell, source of pollution, faulty pump etc.





STEP 2

COLLECTING THE CONTROL

- A control is used to compare the colour change in the test samples, and to ensure that the sample bottles are not contaminated before use.
- You need to collect the control only once for each monitoring programme.
- Collect a sample of uncontaminated water e.g. distilled water, boiled water, bottled water, water treated with chlorine. This is to be used as the control.
- There may be a slight change in the colour of the sample to a pale yellow or light brown due to the colour change of the reagent. This is normal.

Note!

- Do not open the test bottle until you are ready to fill them with your water sample
- Make sure that no contamination occurs e.g. by touching the mouth of the bottle.
- Do not hold the cap from the inside.

STEP 3

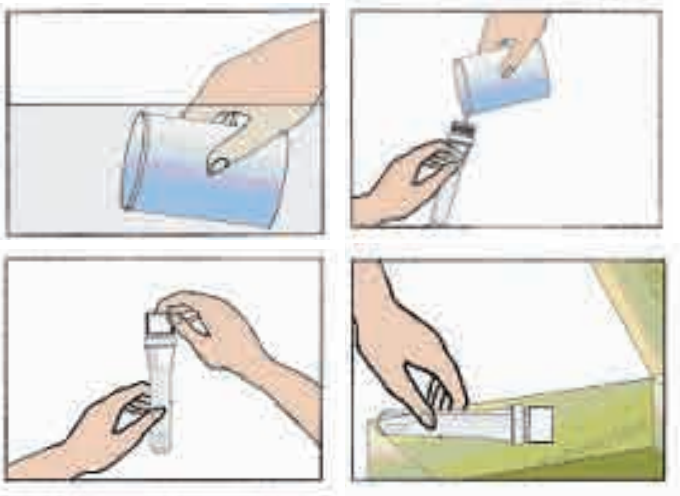
COLLECTING THE WATER SAMPLE

A FROM THE TAP

- First clean the mouth or the outlet of the tap with a clean cloth.
- Turn on the tap and allow the water to flow for 15 to 20 seconds.
- Collect sample water from the tap by filling the sample bottle up to the mark.
- Fill the test bottle carefully, this is because the test bottle will fill very quickly to the marked line and may overflow.
- If you do overfill the bottle, do not spill the water out and do not worry. Your result will still be valid.
- Immediately close the sample bottle.

B FROM STORAGE CONTAINERS SUCH AS WATER TANKS, BOREHOLES AND WELLS

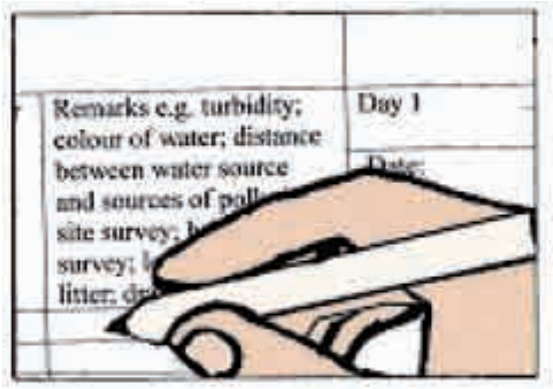
- Rinse the container to collect the water several times.
- Collect a sample of water from the container by filling the sample bottle up to the mark.
- Close the sample bottle.
- Place all the test samples in a dark place at room temperature.
- Wash your hands!

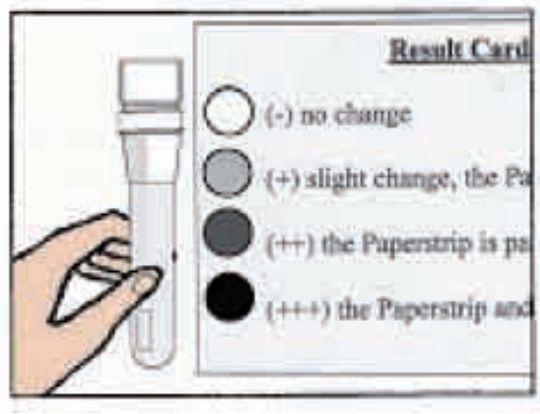


STEP 4

CHECK YOUR RESULTS

- Check your test sample at the same time each day for 3 days for changes in colour.
- Record the date and time for each observation on your recording sheet and your result for each day.
- Compare the colour change with that of the control.
- Use the H_2S Colour Code to indicate the degree of contamination.





Result Card
H_2S Colour Code

(-) no change.

(+) slight change, the Paper strip or water sample has turned light brown.

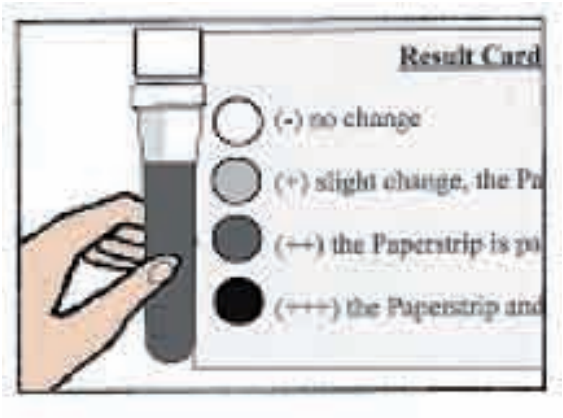
(++) the Paper strip or water sample is dark brown.

(+++) the Paper strip and the water sample are noticeably black.

STEP 5

WHAT DO YOUR RESULTS MEAN?

- (-) If there is no colour change this indicates that the water is clean and free from bacterial contamination.
- (+) If the water has turned light brown, there is a possibility that bacteria, is present in the water. Wait for a few days and check again.
- (++) If the colour change is dark brown then there is some amount of bacterial contamination in the drinking water. You may want to set up a regular monitoring programme and boil your drinking water! Conduct a sanitary survey to check whether your water source is protected from contamination.
- (+++) If the paper strip and the water sample are noticeably black then there is a very high risk of bacterial contamination in the drinking water, therefore, it is not safe for drinking. Take action!
- (+++) If there is a fast reaction- that is, the water solution and paper strip turns black overnight, that means that there is a high probability of bacteria present!
- If your water is contaminated! You should clean out your water storage containers, tanks or well and boil the water before you drink it! Conduct a sanitary survey to look for the source of contamination. Sample the water in your well, tanks and containers again after this to check if you have eliminated the contamination.



Note!

- Keep the test bottles stored away from children! Do not put it in a place where a child can reach it!
- When you return the used test bottles, you will then get replacements.
- Do not open the used bottles!

HOW TO FILL IN THE RESULT RECORD SHEET?

Every time a Water Sampler is going out for water monitoring, he or she needs to fill in the provided Result Record Sheet.

All the relevant details need to be filled in the Sheet.

1. Fill in the address or where you doing the water sampling e.g. K. Huraa, Health Care.
2. Write in your sample number in the first column.
3. Fill in the type of water that you are sampling e.g. rainwater.
4. Record the date and time of sampling.
5. Identify the location of your sample e.g. the Ameer Ameen School main water tank.
6. In the "Remarks" column, fill in information like the color of the water, the smell, or if there is faulty tap or pipe.
7. Use the colour code to find out your results- e.g. "+" or "++" and record this in the "Results" column. Fill in your observation each day for three days and record the date and time of observation.
8. The "Notes" column can be used for other information like the source of contamination or if there is a latrine built within a short distance from the drinking water source.

EXAMPLE OF THE RESULT RECORD SHEET. THIS IS PROVIDED IN YOUR TOOLKIT.

H_2S PAPERSTRIP TEST – RESULT SHEET.

Address: _____

_____

Name of Water Monitor: _____

_____

						RESULTS		
Sample Number	Type of water source: (deep well – borehole, rainwater etc.)	Date:	Time:	Location: place where the sample is collected	Remarks	Day 1 Date: Time:	Day2 Date: Time	Day 3 Date: Time:
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Notes:

HOW TO FILL IN THE SANITARY SURVEY SHEET?

It is important to fill in the Sanitary Survey Sheet every time there is water sampling.

The Sanitary Survey contains information that is linked to the water source or the water storage container e.g. drums and tanks. You can use the sanitary survey sheets provided for water tanks, boreholes and wells to find out if your water source is being contaminated.

You can link the result that you got from the H_2S test with that the result from the Sanitary Survey of the same water source.

Before filling in the Sanitary Survey Sheet, make sure that you are filling in the correct Sanitary Survey Sheet. If collecting water from the rainwater tank, then fill the Rainwater Collection and Storage Form.

1. Fill in the General Information e.g. Name of the island etc.
2. Fill in the Sample number from where you are collecting your sample.
3. Answer the Provided Questions and circle or tick “Yes” or “No”.
4. Total the score of risks.
5. Refer to the Contamination Risk Score.
6. Try to link your Risk Score with the Result from H_2S test after the 3 days observation. If your water is contaminated, the sanitary survey sheet will give you a good idea why and where the source of contamination is from.

1 ACTIVITY: WATER AND HEALTH

30 minutes

Purpose:

- To increase awareness of water related diseases and the links between water and health.
- To identify the source of drinking water and identify water problems faced by their community.

Materials needed:

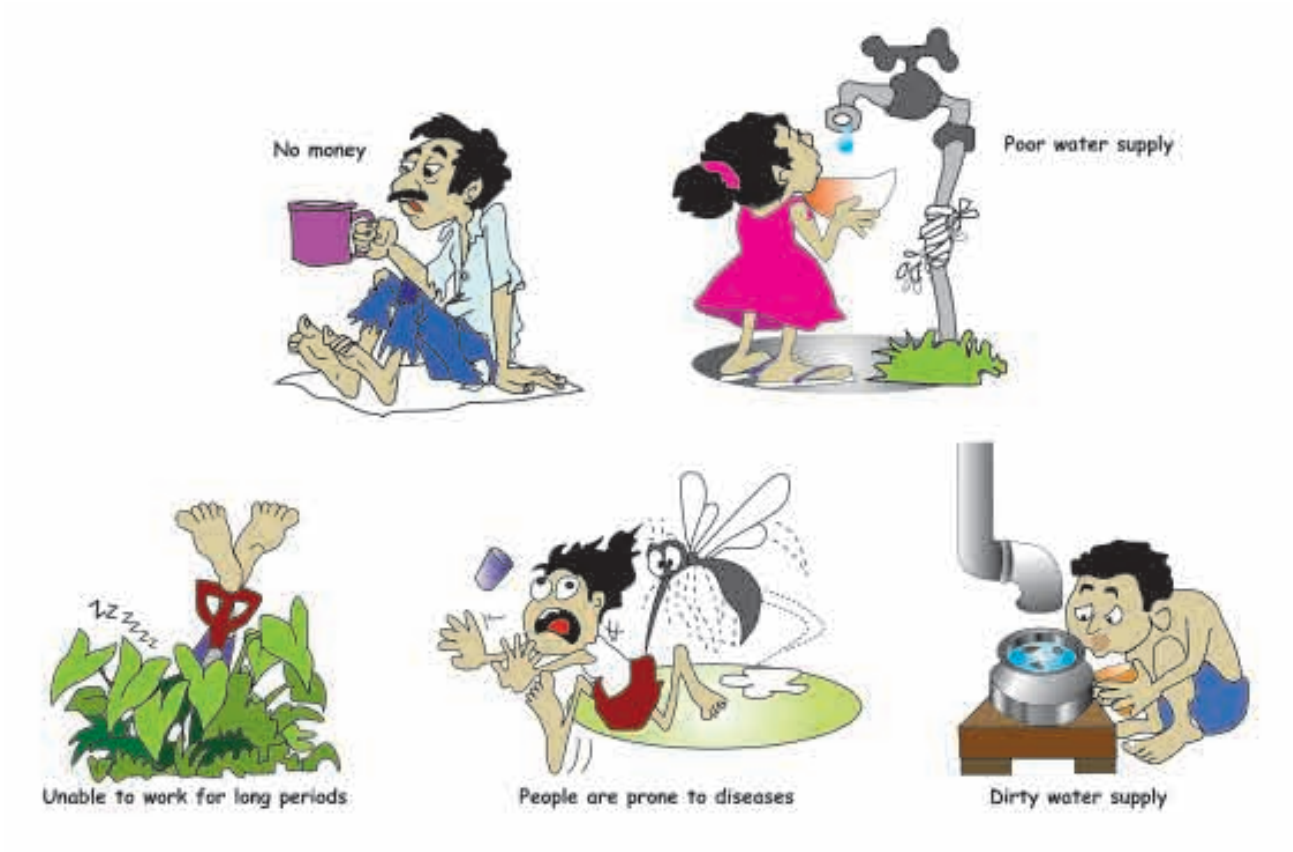
newsprints/ butchers paper, picture cards and markers

What to do:

1. Divide the group into smaller groups of 5-8 members.
2. Identify a leader, a recorder and a note taker for each group.
3. Distribute the newsprints and markers to each group. Give out the picture cards.
4. The groups should use the cards to construct a cycle of ill health and poverty. Each group should then discuss their cycle.

- What was the main cause of the cycle of ill health and poverty?
- Can the cycle be broken? Where and how?

PICTURE CARDS



5. Then ask each group to list their various water sources.
6. If the community has access to more than one water source, get each group to choose one. One group may choose the water tank, while the other group chooses the well.
7. The groups should draw their water source in the middle of the newsprint. Ask the group to draw arrows pointing in towards the water source with labels or drawings showing ways in which contamination of their water source can occur.
8. Draw arrows pointing out from the water source with labels or drawings showing the impacts of drinking contaminated water in their community.
9. Ask each group to present their drawings to the rest of the group and encourage discussion and questions. The following questions will help you to focus your discussions:
   - What are some of the factors that might affect drinking water supplies?
   - What are the water- related problems faced by the community?
   - How do these problems affect the community? The family? The children?
   - Are these problems easily resolved?
   - What are some things we can do to address these problems?

2 ACTIVITY: COMMUNITY AND TIMELINE

Purpose:

- To identify major developments and changes in the community over the last 40 years
- To explore social, economic or environmental impacts to the community over the last 40 years.

Materials needed:

newsprints or butchers papers, markers

What to do:

1. Break participants into groups of the men, women and youth and identify a group leader, a recorder and a presenter for each group.
2. Distribute the newsprints and markers to each group. Paste an example of a Community Time line on the wall.
3. Each group should draw a Community Timeline and fill it in with changes that have occurred in their community and the impacts these changes have had. Give these key areas to the groups to help them to focus on what they should fill in the table:
    - Number of households; road type; crops grown; fuel source; education; infrastructure; transport; mass media and any other types of developments

EXAMPLE OF A COMMUNITY TIMELINE:

TIME	DEVELOPMENTS	COMMENTS
1960 -1970	Number of households - 10 Roads – gravel road Water source – well Who manages water - Leadership - Chief Education- teacher Health - Community Health Worker	Very quiet, plenty of space Good gardens, fruit trees, wild foods in forest Clean air, clean compounds Isolated; island road very dusty
1970 - 1980	Households- 21 Roads-gravel road Water source-well and water tank Who manages water- Leadership-Chief Education-2 nurses, 3 teachers, 13 primary school children	Gardens, fruit trees, wild foods in forest Clean air, clean compounds Isolated; island road still very dusty and many potholes.
1980 – 1990		
1990 - 2005		

4. When the groups have finished they can present their findings to the rest.
5. Facilitate a group discussion and highlight key points that are raised by the groups, especially on water issues. These questions should help:
    - What were the major developments?
    - What impacts did these developments have on community and people's lifestyles? Health? Economy? Environment?
    - What developments were water- related?
    - Did any of the developments have an impact on water resources? Why and how?
    - How can water be maintained to be clean and safe for the people to use?
    - How can the decision making processes in relation to water resource use and management be improved?
    - How can the people deal with other issues identified?

The first 3 activities of the guide are designed to first get communities exploring the links between water and health and look at how developments and peoples' actions affect the water resources.

After facilitating the previous activities and discussions, your group should be more aware of the need for community action to protect their health and drinking water.

Testing their water supplies and setting up a regular monitoring programme should be a good beginning for community action!

3 ACTIVITY: HOW CLEAN IS OUR WATER?

1-2 hours

Purpose:

- To test for faecal contamination in drinking water using the H_2S Paper Strip Test.

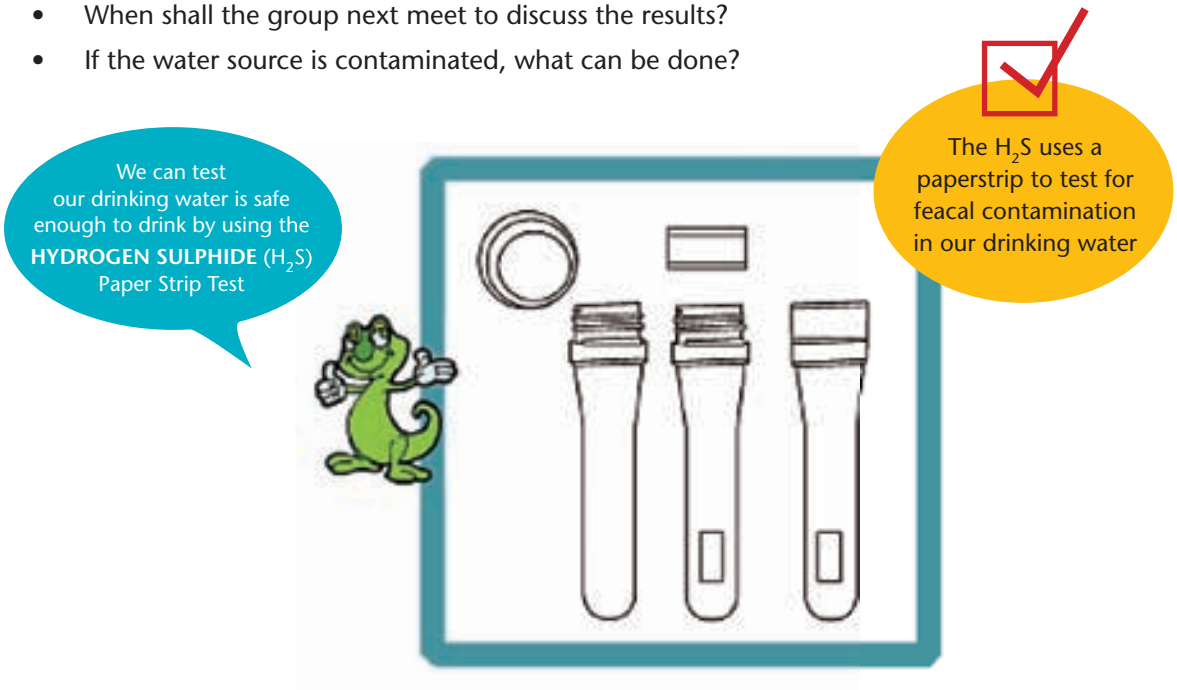
Materials needed:

H_2S Paper Strip Test bottles and Instruction Guide, Result Recording sheet, Sanitary Survey Sheets.

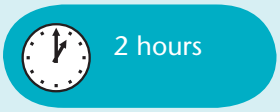
What to do:

1. Divide the participants into two or more groups. Each group should assign a Group Leader and a Note Taker.
2. Distribute the H_2S Paper Strip test bottles and instruction guide, Result Record Sheet and Sanitary Survey Sheet to each group.
3. Allocate each group to the various water sources in the community- rainwatertank, boreholes, wells etc.
4. Once out in the field, each group is to carry out a survey of the water storage container or source using the appropriate Sanitary Survey Sheet.
5. After doing the sanitary survey, the groups are now ready to test the waters!
6. Use the H_2S Paper Strip Test Instruction Guide! Assign someone in the group to read out the instructions for carrying out the test. Follow the steps carefully.
7. After the water testing the group can return back inside the meeting room for further discussion. These questions should help you to facilitate discussions:

    - Were they able to follow the instructions?
    - Was the Sanitary Survey Sheet useful? How?
    - What other observations did they make of the surrounding environment or of peoples behaviour?
    - Were the water sources located nearby a rubbish heap or toilet?
    - Who will be responsible for checking and recording the results?
    - When shall the group next meet to discuss the results?
    - If the water source is contaminated, what can be done?



4 ACTIVITY: TAKING ACTION



Purpose:

- To determine the water problems, identify causes, potential solutions and plan for action.

Materials needed:

Newsprints, marker pens and cards.

What to do:

1. After the groups have tested their drinking water they may want to develop an action plan to regularly monitor their water supply or to address their water issues.
2. The group can develop a work plan- this examines the issues, the effects, the causes, potential solutions, people responsible, proposed time when changes should take place and indicators of success. Draw a work plan table for the group using the example given below.
3. Distribute the tasks to be done amongst group members. Give out coloured card and write the name of the person responsible in the top left hand corner of the card or note paper.
4. Give each task a deadline and stick the card onto the work plan or a calendar outline.

Note to the Facilitator!

- Have regular meetings to review your work plan and fill in any missing tasks that come to mind – write a new action card for each additional task and place on the planning calendar.
- Review progress, as a group, on a regular basis. Cross out each accomplished task with a bold red line. Replace action cards and give a new date if behind schedule.Do not open the used bottles!
- Celebrate every small task when it gets done!

SAMPLE WORK PLAN

PROBLEMS	CAUSES	EFFECTS	SOLUTIONS	WHO IS RESPONSIBLE	WHEN TO TAKE ACTION	INDICATOR OF SUCCESS
Dirty Drinking water especially from the well and rainwater tank	**TANK:** Dead leaves and debris from the gutter. No sieve on the mouth of the tank Tank are not washed regularly Drainage system under the tap **WELL:** Well not covered People throwing their rubbish in the well Birds dropping found in the well Cracks on the wall of the well	Water related diseases like diarrhoea Scabies	Clean the gutter Place netting or small gravels on the mouth of the tank to trap dead leaves and other debris Clean a drainage system under the tap of the tank. Clean the tank once or twice a year Provide a lid or cover for the well stop throwing rubbish in the well repair the cracks on the wall well to be washed regularly	Island Office, Island Development Committee & Individual householders	Plan of Action to be taken up during the rainy season July	Clean water Decrease in the number of water related diseases Clean well and tank
Leaking Pipe	Damage tap and pipe	Dirty drinking water	Repairmen of the pipe and change the tap	Individual householders	July	Clean water. Good tap and good drainage system

NOTE TO THE FACILITATOR!

As a Water Educator or Facilitator, you will need to know some skills that will enable you to work well with your participants and also to provide a good learning environment during the course of training.

Below are some tips that you could use as the facilitator when you are carrying out the training in the field.

WHAT MAKES A GOOD FACILITATOR?

- Warm personality, with an ability to show acceptance of participants.
- Social skills, with an ability to bring the group together and control it.
- A manner of teaching which generate and uses ideas and skills of participants.
- Organizing ability, so that the resources or venues are booked and workshop or meeting logistics arranged smoothly.
- Skills in noticing and resolving participants' problems.
- Enthusiasm for the subject and being able to put it across in an interesting way.
- Flexibility in responding to participants' changing needs.
- Knowledge of the subject matter.

HERE ARE A FEW TIPS FOR GOOD FACILITATION!

- Look at the group members; do not stare at your notes or the guide. Make eye contact with the whole group by letting your eyes roam around the room. Call members by their right name.
- Smile – even if you are nervous or uneasy.
- Avoid placing barriers between yourself and your group members. Be open in your posture and sit at the same level as the group members.
- Avoid distracting body movements e.g. don't fiddle with pens or touch your hair. Your audience might focus on these nervous gestures rather than listening to you.
- Speak clearly and do not be afraid of pauses.
- Prepare thoroughly a day before your training to familiarize yourself with the task ahead of you. This might also build your confidence.
- Start talking to group members as they begin to arrive, smile and be relaxed.
- Speak to group members as equals, use the words 'we' or 'our' instead of 'you' or 'your'. For example, 'we have to' and 'our project, rather than 'you have to' and 'your project….'
- Have breaks/ games or energisers when appropriate.
- Pause after your key points to allow the group to absorb them. This is the moment to look carefully at the participants. You will be able to tell whether they have understood you from the expression on their faces and their body language.
- Act a little. In a large group you have to go a long way before you are in danger of going over the top.
- Speak clearly. A clear voice carries further and sound better. It also does not become strained so easily. Sound the words carefully. Do not let them run together.

NOTE TO THE FACILITATOR!

BE SURE TO ASK QUESTIONS!

- Test assumptions/ bias & invite participation
- Gather information & Probe for hidden points
- Promote discussion & Develop a deeper understanding of what is being discussed
- Peel away surface layers.

THE IMPORTANCE OF NOTE TAKING!

- Recording what happens during your workshop or meeting is very important as it can help people to stay focused, and it makes it possible for the group to see how its views have developed and to share experiences with other groups.
- Written notes also make it easier to include any initiatives or activities undertaken by the community in a newsletter or on a website and other communities can be aware of activities.
- Keeping notes also shows that the knowledge and experiences of community members is valued.
- Notes could cover things such as:
  - What has been covered/discussed/discovered;
  - Key issues/ideas;
  - Points of particular controversy;
  - greed action outcomes, activities.
  - Choose a note taker or decide whether one person will take on the job or whether the role will be shared around.

AND FINALLY, EVALUATE YOUR PROGRESS

- As a facilitator, you need to get feedback about what worked well, what didn't work, any changes that need to be made to the resource materials or facilitation, and extra work that you might need to do.
- You can prepare evaluation forms to be distributed to participants at the end of your workshop.
- Evaluation in communities should be a time for members to look back at what they have achieved and celebrate achievements!

SANITARY SURVEY SHEET

Island:

Household name:

Date:

Number of people living:

Children between 0-5 years:

Surveyor:

Interviewee:

RAIN WATER

1. Which water source do you use for drinking?

   a. Well water ☐ b. Rain water ☐ c. Others ☐

2. Does your household have a private household rain water tank?

   a. Concrete ☐ b. Plastic (HDPE) ☐ c. Capacity of tank (litres) ☐

3. Do you ever run out of rain water?

   a. Months ☐ b. Never ☐

4. What purposes do you use rain water for?

   a. Cooking ☐ b. Drinking ☐

5. Where do you source alternative drinking water supply from?

   a. Mosque well ☐ b. Communal tanks ☐ c. Other ☐

6. Who is responsible for collection of rain water?

7. Is the rain water tank clean?

   a. The area surrounding rain water tank is clean ☐

   b. The roof and gutters are clean ☐

   c. Top of the tank is clean ☐

   d. There are no overhanging branches over the roof ☐

   e. The rainwater tank is covered ☐

   f. First rains flushed by not connecting to tank. Yes ☐ No ☐

8. Is there a sewer system in the island?

   a. Yes ☐ b. No ☐

9. What sanitation facilities do you use?

   a. Toilet ☐ b. Gifili (with open defecation area) ☐ c. Beach ☐

12. How do you dispose of the septic waste?

   a. In the household compound ☐ b. Through pipes going to the sea ☐

13. Do you clean you septic tank on a regular basis?

   a. Yes ☐ b. No ☐

14. Where do you dispose of the septic waste?

a. Household compound ☐ b. Sea ☐ c. Waste Management Centre ☐

15. Are there any signs which may lead to ground water contamination?

a. Area surrounding the well is clean ☐
b. There are no unpleasant odors in the area surrounding the well ☐
c. The well is covered ☐
d. There are no cracks in the well ☐
e. There are no cracks on the concrete platform adjacent to the well ☐
f. There are no signs of waste near the well ☐

16. Are there any problems with the well water? (if the answer is Yes, define the problem)

a. It has a bad smell ☐ b. It has a bad taste ☐ c. Colour ☐ d. Other ☐

HYGIENE

17. There is soap,

a. In the toilet ☐ b. In the dining room ☐ c. In the kitchen ☐

18. Did anyone in the household have diarrhoea? What was the cause of it?

a. Number of people ☐ b. Age(s) ..... ☐

19. Rate the cleanliness of the household

a. Very clean ☐ b. Clean ☐ c. Not Clean ☐

20. If the surveyor observed any problems that may lead to contamination of water, please make a note of it here.

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21. When the health worker or health personnel visit the household, does he / she discuss about

a. The importance of cleaning hands with soap ☐
b. How to collect rain water properly ☐
c. Food and hygiene ☐
d. General hygiene ☐
e. Diarrhoea and worm infections ☐
f. Why it necessary to boil well water before consumption ☐

INFORMATION FROM THE HEALTH PERSONNEL

- Are diarrhoea and typhoid common diseases in the community?
- During the rainy season does the number of cases reported with diarrhoea or typhoid increase?
- Gather information about the cases reported with diarrhoea, typhoid or other similar diseases for the past six months.

H_2S PAPERSTRIP TEST – RESULT RECORD SHEET

Address: .....

Name of Water Monitor: .....

Sample Number	Type of water source: (well – borehole, rainwater etc.)	Date:	Time:	Location: place where the sample is collected	Remarks	Day 1 Date: Time:	Day 2 Date: Time:	Day 3 Date: Time:
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								

NOTE: .....

.....

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1 Indicate under "Remarks" if the water is visibly turbid, coloured, or contain solids or materials in suspension. Also, note any problem at the sampling site like a leaking tap, unclean area, drainage problems etc

2 Notes: Indicate the distance between the water source and any other sources of pollution like a compost pit, septic tank, toilet or farm.

3 RESULTS: a (-) indicate a negative- the water is clear; a (+) light brown, a reaction has started; (++) the paper strip is now dark brown; (+++) the paper strip and the water is visibly black/ the reaction is very fast.

MWSA INFORMATION SHEET:

Emergency Disinfection of Community Water Sources using Chlorine

Instructions for the temporary disinfection of contaminated wells and rainwater tanks by Public Health Units and Family Health Workers in the occurrence of a waterborne disease outbreak.

STEP 1

CALCULATE HOW MUCH CHLORINE IS REQUIRED FOR DISINFECTION

To obtain the recommended safe chlorine residual of 0.3 mg/l, if using bleaching powder that is 30% chlorine, use the quantities given below.

Make sure that the teaspoons are level and not heaped.

NB: If the tanks are half full then use half the quantity of bleaching powder. If they are a quarter full use a quarter of the quantity and so on.

RAINWATER TANKS

CAPACITY OF RAINWATER TANK	QUALITY OF CHLORINE
Full rainwater tank of 2,500 litres	1 level teaspoon
Full rainwater tank of 5,00 litres	2 level teaspoon
Full rainwater tank of 10,00 litres	4 level teaspoon

STEP 2

CHLORINATING THE RAINWATER TANK OR GROUNDWATER WELL

The bleaching powder should be thoroughly mixed with 5 liters of clean water. Add the powder to the water, never the other way around.

Once mixed the white calcium carbonate deposit should be removed by filtering the solution though a fine muslin filter. The clear solution can then be slowly added to the well and the well water stirred using a dhani.

See Reverse for Important Safety Precautions

GROUND WATER WELLS

FOR A 1 METER DIAMETER WELL	
Depth of water from the bottom of well to water surface is 1 meter	ONE THIRD of a level teaspoon
Depth of water from the bottom of well to water surface is 2 meter	TWO THIRDS of a level teaspoon
Depth of water from the bottom of well to water surface is 3 meter	ONE level teaspoon

SAFETY PRECAUTIONS

- **Take care when handling bleaching powder and the solution. Do not inhale the powder. Wear rubber gloves, goggles and a mask when handling the powder and the solution.**
- **Wash any spilt solution or powder with excess amounts of water. Any contamination to the eyes should be immediately and thoroughly irrigated with fresh water and a doctor consulted as soon as possible.**
- **DO NOT store bleaching powder near any oil or diesel fuel - if it mixes it will explode.**
- **Keep all bleaching powder containers tightly closed and in a dry cool place. Store off the floor.**
- **Always store the chlorine solution out of sunlight and keep container covered.**

These instructions are for temporary disinfection of community wells and rainwater tanks. Once the rainwater tanks fill with further rain they can no longer be considered disinfected and the procedure would have to be repeated. Groundwater wells will become contaminated within several days as the water circulates if the contamination source is not identified and removed.

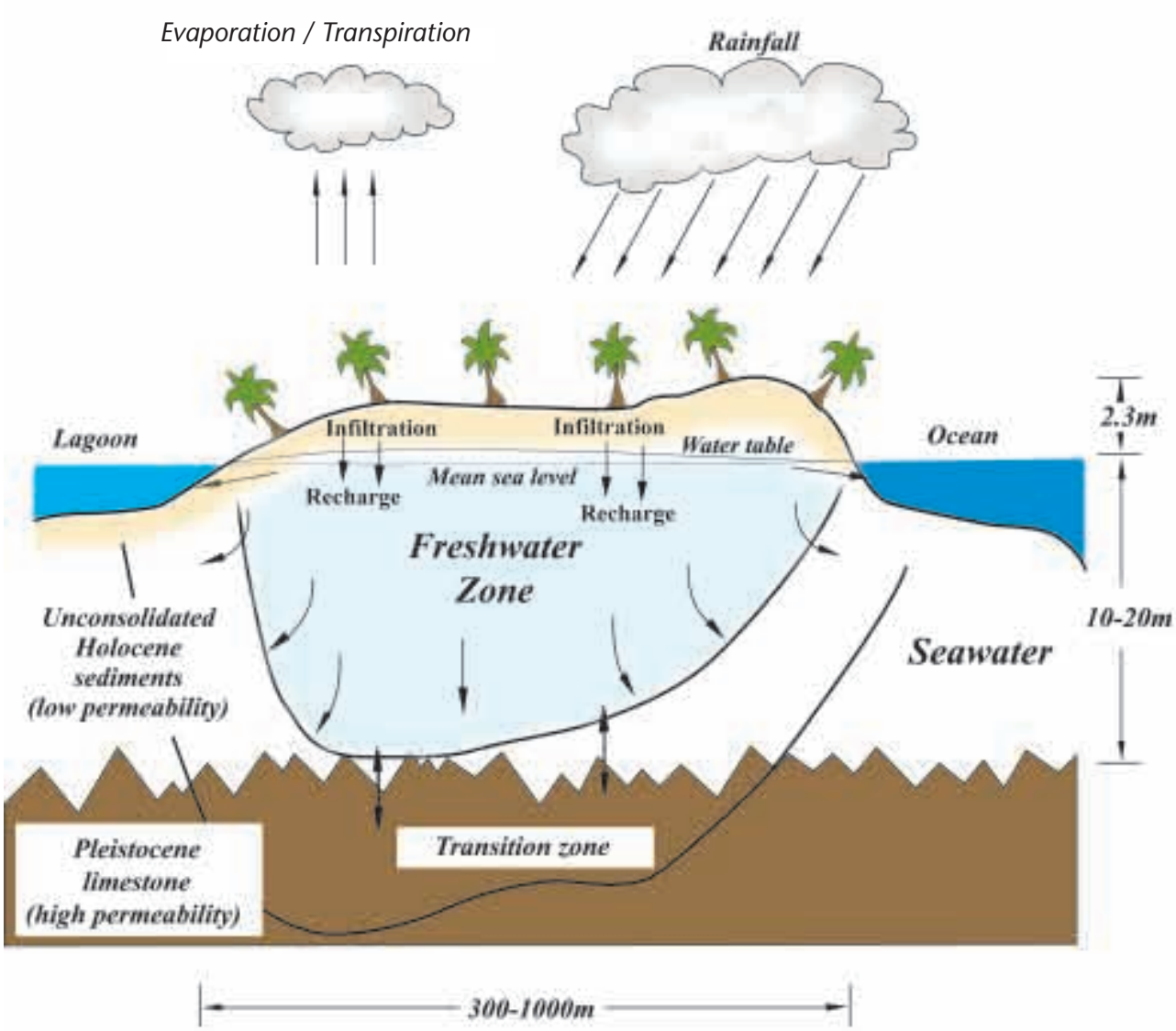
For further information please contact MWSA:

Maldives Water and Sanitation Authority
Male', Republic of Maldives Ph : 3317562 Fax : 3317569

FACT SHEETS

1 WATER GOING SALTY IN THE WELL

Well water is used by all households in the Maldives. Most communities use the well water for all non-drinking uses such as washing, bathing and toileting. Well water provides about 90% of the household water needs. However during the dry season up to 70% of households report their rainwater drinking supply runs out. Households then have to use neighbours rain tanks or use the household or mosque wells. Well water is therefore very important to the household.



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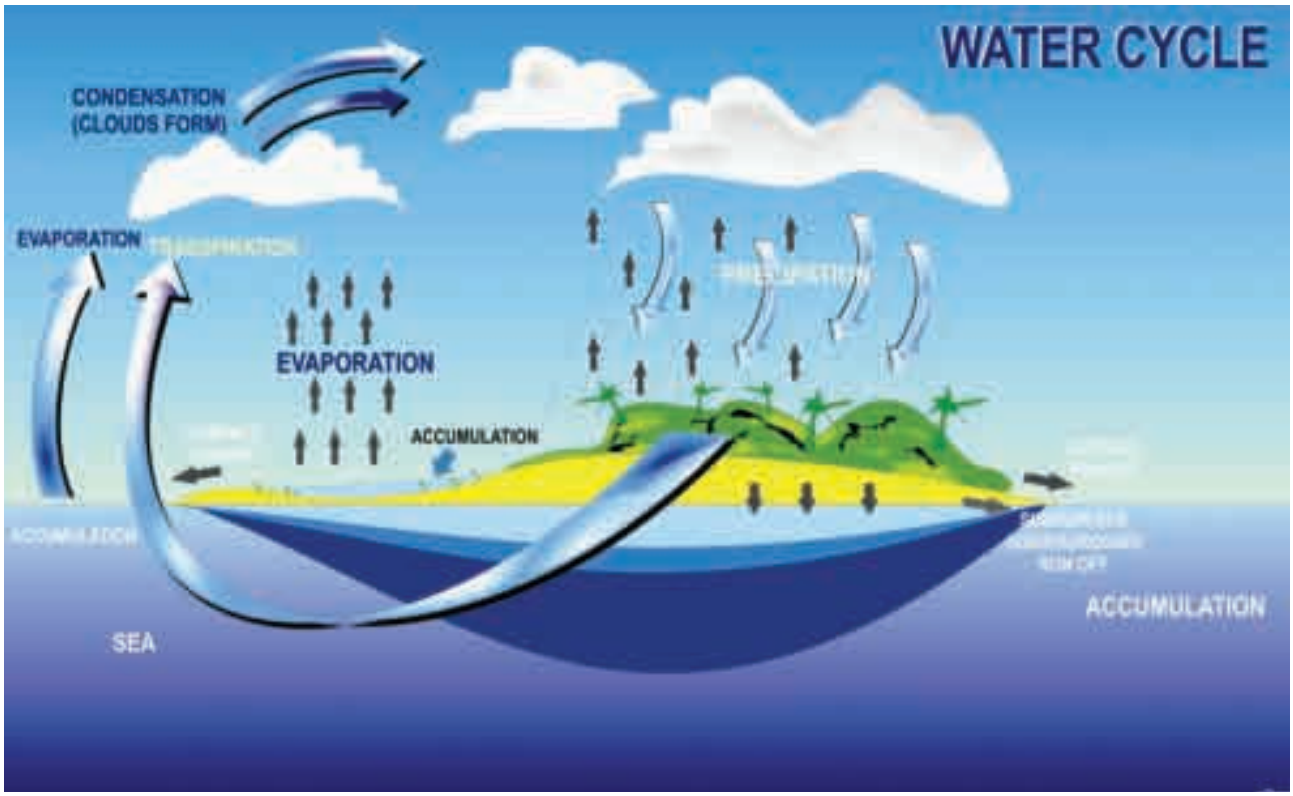
i) When can I drink well water?

The saltiness or salinity of the well water varies from well to well depending on several factors which are explained below. You can use well water for drinking if it has a salinity reading of <2,500 µS/cm. If it is more salty than this drinking it will make you sick. You can still use the well water for non-drinking and non-cooking uses though.

ii) Why is there fresh water in the ground?

All small islands are surrounded by the sea which is salty. The rain which falls on the island is fresh. About a third of this rainfall will soak into the ground and infiltrate into the coral sand. This water collects in the sand and forms a body of fresh water. The freshwater is not very thick however (typically 2-7m on smaller islands) and floats on salt water that is underneath it, that has entered the sand below the sea level. The infiltrated freshwater eventually flows to the sea.



iii) Why does the groundwater salinity vary across the island?

The freshwater body or lens is surrounded by the sea. The seawater also tries to get into the islands coral sand, but is pushed out by the freshwater entering from the rainfall. However the nearer you get to the coast the closer you are to the sea, and the easier it is for seawater to come into the land. At the coast there is no freshwater lens so the groundwater becomes salty. The further inland a well is located, the greater the thickness of the freshwater lens and the fresher the water.

FACT SHEETS

iv) Why does my well water get more salty during the dry season?

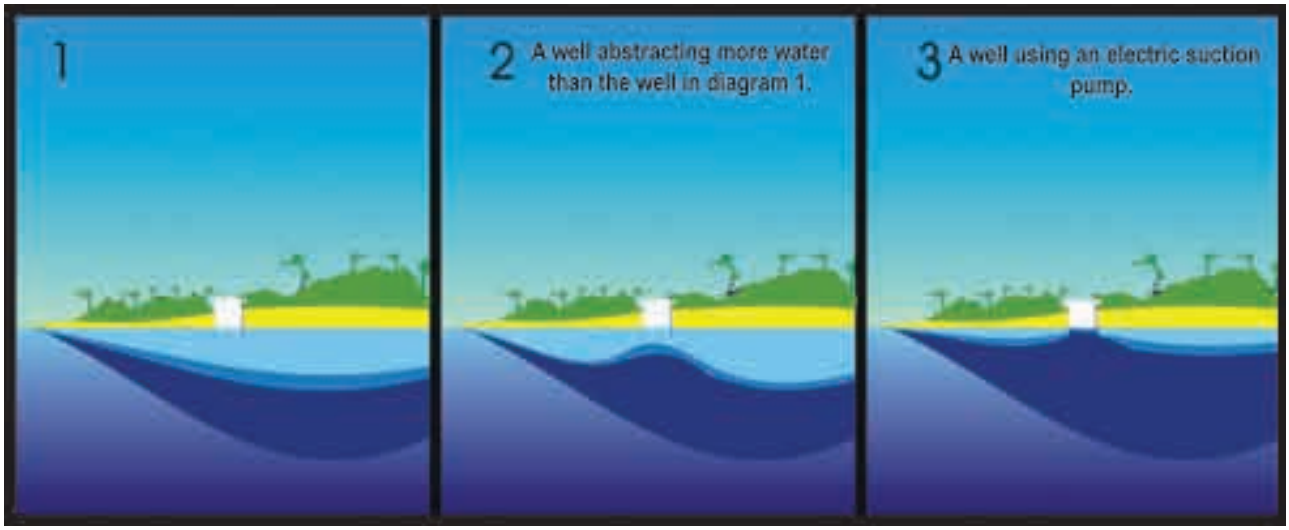
During the dry season the amount of rainfall is reduced and this means the amount of freshwater entering the freshwater lens is also less. This means the freshwater flows within the groundwater are less and this means that more seawater can enter the island. The freshwater lens then gets smaller. If you live towards the edge of your island, you will notice your well water getting more salty during the dry season.

v) Why is my dhani well less salty than my pumped well?

Dhani wells tend to be fresher than pumped wells for two reasons. Firstly less water is taken from a dhani well than a pumped well. This means there is more freshwater left in the ground and so the lens stays fresher.

The pumped well abstracts more groundwater, which reduces the amount fresh groundwater available to push out the seawater, and so pumped wells tend to be slightly more salty.

Also pumped wells lower the water level in the well more than dhani wells. There is a relationship between the height of the freshwater level above the sea level and the amount of freshwater in the lens below sea level. Generally for every 1cm of freshwater above mean sea level there is 20 cm below it. So when a pumped well lowers the water level in the well by too much, the freshwater lens thickness below the well reduces and saline water comes up and into the well. This is known as saline-up-coning.
The more water you take from your well, the more likely it will become salty.



vi) How much water can I take before my well gets salty?

This is a difficult question to answer. It depends where your house is located on the, what type of abstraction method you use (dhani or pump), whether you put rainwater overflow water in the well, how you operate your pump (continuously or on demand), how much water your neighbours are taking, and how much of the waste water you return back into the ground.

If the island has a sewerage system, the whole island may be abstracting too much groundwater to the sea. In this situation groundwater may continue to get more salty.

MWSA can provide a general household guide for abstraction once they have carried out a water resources assessment of the island.

vii) How can I make my well less salty?

There are several simple things you can do to make your well water as fresh as possible. These are listed below:

- Direct your rainwater tank overflow either directly into your well or into the ground next to your well. If you are not collecting all the water off your roof for rainwater harvesting then catch the rest and route it into the well.
- Construct your well with small holes in the side of your well wall lining below the water level. This allows very shallow fresh water to enter the well. This will be fresher than water entering the well through its base alone.
- Use the dhani abstraction method in preference to the pump method.
- Make sure your pump is of as low an abstraction rate as possible. Large pumps will provide your water more quickly but reduce the water level in the well by a greater amount too.
- Ideally get your pump to feed a water storage tank next to your roof, and pump to it at a constant rate all day and night. The storage tank can then provide your daily supply under gravity. This will minimise water the lowering of the well water level.
- Only take the water you need. Do not waste water.
- Put your washing water into a catchpit or trench in your household plot (but away from the well). Do not put used wash water into the septic tank or the sewer line. Washed water is freshwater (if it does not contain faeces or urine) and can recharge the freshwater lens. Putting it in the sewer line will send it into the sea and it will be lost from the island.
- Use smaller flush tanks (small 6 L tanks) for the toilet as less water is required for flushing than if you use a 12 L tank.

FACT SHEETS

2 WELL CONTAMINATION AND PREVENTING IT

Well water is used by all households in the Maldives. Most communities use the well water for all non-drinking uses such as washing, bathing and toileting. Well water provides about 90% of the household water needs. Well water is therefore very important to the household.

HEALTH RISKS FROM DRINKING CONTAMINATED WATER

Unfortunately, all surveys of well water show that well water is of worse quality than rainwater. It usually has about 100 times more bacteria in it and is 100 times more salty than rainwater. Some wells also contain contamination from septic tanks

If you drink well water that contains too much bacteria then it will make you sick, and give you diarrhoea and vomiting. This can lead to dehydration and for vulnerable people (children and the elderly) even death.

When people get infected with diseases such as diarrhoea, typhoid and hepatitis A , their excreta will contain large amounts of the germs which cause the disease.

When people defecate in the open, flies will feed on the excreta and can carry excreta on their bodies. When they touch food excreta and germs are passed on the food. Where there are germs there is always a risk of disease.

During the rainy season, excreta may be washed away by rainwater and can run into wells contaminating the wells.

In many cultures it is believed that children's faeces are harmless and do not cause disease. This is not true. A child's faeces contain as many germs as an adult's, and it is very important to collect and dispose of children's faeces quickly and safely.

Many common diseases that can give diarrhoea can spread from one person to another. Disposing of excreta safely, preventing faecal contamination of water supplies and improving personal hygiene particularly hand washing with soap (at critical times such as after going to the toilet, before eating and food preparation) would greatly reduce spread of diseases significantly.

Water which is too salty will make you vomit, and may make your skin itchy and sore. Most well water is not too salty for drinking. Your health post may be able to test your well for salt. People can drink salty water with a conductivity reading up to 2,500 µS/cm. The saltiness or salinity of your well is considered in a separate fact sheet.

However because of the bacteria and other compounds from septic tank discharge it is always better to drink rainwater than well water.

RISK OF CONTAMINATION AT THE WELL

There are a number of factors which affect the vulnerability of your well and therefore the likelihood of your well becoming contaminated. These are:

i) Condition of the Well

The well consists of a circular wall, rising above ground level, and penetrating usually 1.5-2.0m into the ground. The well is usually open at the base. Any cracks in the wall will enable water to enter the well without first passing through the ground. This means water contaminated at the ground surface from household activities can get rapidly into the well.

Water often gets spilt around the well, when pouring the dhani into jugs and bowls. This water falls onto the ground and this will infiltrate back into the well. This water may carry contaminants from household activities with it. The concrete floor around the well must be free from cracks to avoid contamination of the well from used water.

Water used after washing often cause ponding around the well if there is no proper drainage channel to direct water away from the well.

Many wells do not have a cover on them. This means insects (especially mosquitoes), small animals and debris can fall into the well.

As people believe that children's faeces are safe and do not contain germs, proper attention is not given in disposing of children's faeces safely. Disposing of faeces or cleaning soiled clothes must not be done near the well.

All of these are causes of microbiological contamination of the well.

ii) Septic Tank Discharge

Surveys show that the main source of contamination of well water is septic tanks. Septic tanks discharge toilet effluent into the ground after some treatment, but the effluent that leaves the tank is still very rich in bacteria, nitrate and ammonia. These compounds make the groundwater go smelly as well as being bad themselves. Nitrate and ammonia concentrations in well water have been found to exceed acceptable (WHO Guideline) concentrations for up to 40% of water wells. It is the bacteria that is the main problem, where almost all wells are contaminated.

The condition, size and maintenance of the household septic tank are contributing factors to affecting the water quality in your well. If the septic tank is cracked or broken then untreated effluent will leak from the tank into the ground. If the tank is too small for your household then the effluent will not stay in the tank long enough for it to be treated. If you don't clean out the sludge from your tank then it won't treat the effluent so effectively.

FACT SHEETS

iii) Location of the well

The distance your well is from sources of pollution will affect its likelihood of contamination. Any well close to the toilet/bathroom, septic tank, washing water soakage pit, rubbish pile or area of ponded water, will be more likely to be contaminated than one further away.

This means you should consider both the location of your well and the location of these sources of contamination. Wells located in the garden, near the house and away from the septic tank will be less polluted. Remember however that your neighbours will also consider these issues. You should talk to your neighbours to agree the best location for all your septic tanks.

Ideally the septic tank should be >15m from your well. The further away the better. (based on MWSA guidelines)

iv) Additional sources of contamination

There are other sources of potential contamination that will exist on the island. The most significant are likely to be fuel oils and chemicals. Some locations, such as the power house will store more of these fluids than others.

Such fluids in the house should never be stored near the well (even if used for a well pump) and ideally should be stored both under a roof and on top of a concrete base. This will stop spillages getting into the groundwater. Once groundwater is contaminated with oils it is very difficult to clean up.

When fuel and chemicals have been finished with they must never be poured into the septic tank systems, but should be taken to the island waste site. Fuels and chemicals will damage the treatment provided by the septic tank and enter the groundwater.

Significant fuel stores at the powerhouse should be stored under roofing, and on a concrete slab covered by the roofing. The slab should have a bunded edge which would enable all the fuel to be held within it should the fuel store leak. Any leak can then be cleared up and removed to the island waste site for incineration.

Washing water will contain detergents. The washing water catch pit can also contaminate your groundwater but to a much lesser extent than the septic tank.

v) Actions to Reduce Well Contamination and Improve Well Water Quality

There are some easy steps you can take to improve the protection of your well and therefore improve its water quality. These are listed below:

a) Repair all cracks to the well walls regularly and make sure it is adequately sealed.

b) Remove all debris from around the well.

c) Put a metal well cover with a hinged lid on the top of the well.

d) Build a concrete apron around the well which will direct spills and rainwater away from the well.

These can be channelled into pipe and flow further away from the wellhead.

e) Make sure the dhani does not stand on the floor and has a hanger to keep it in the air.

f) Clean the dhani, ideally with bleach, once a week.

g) Repair any cracks seen on the septic tank

h) Empty the septic tank at least once a year of its sludge and dispose in the island waste site

i) If you build a new septic tank make sure it is big enough for your household. MWSA can advise you on the design of your septic tank.

j) If you build a new septic tank locate it as far away from your well as possible. Check with your neighbours on the locations of their wells as these might be close to where you intend to put your tank.

k) Move the washing water catch pit away from the well area.

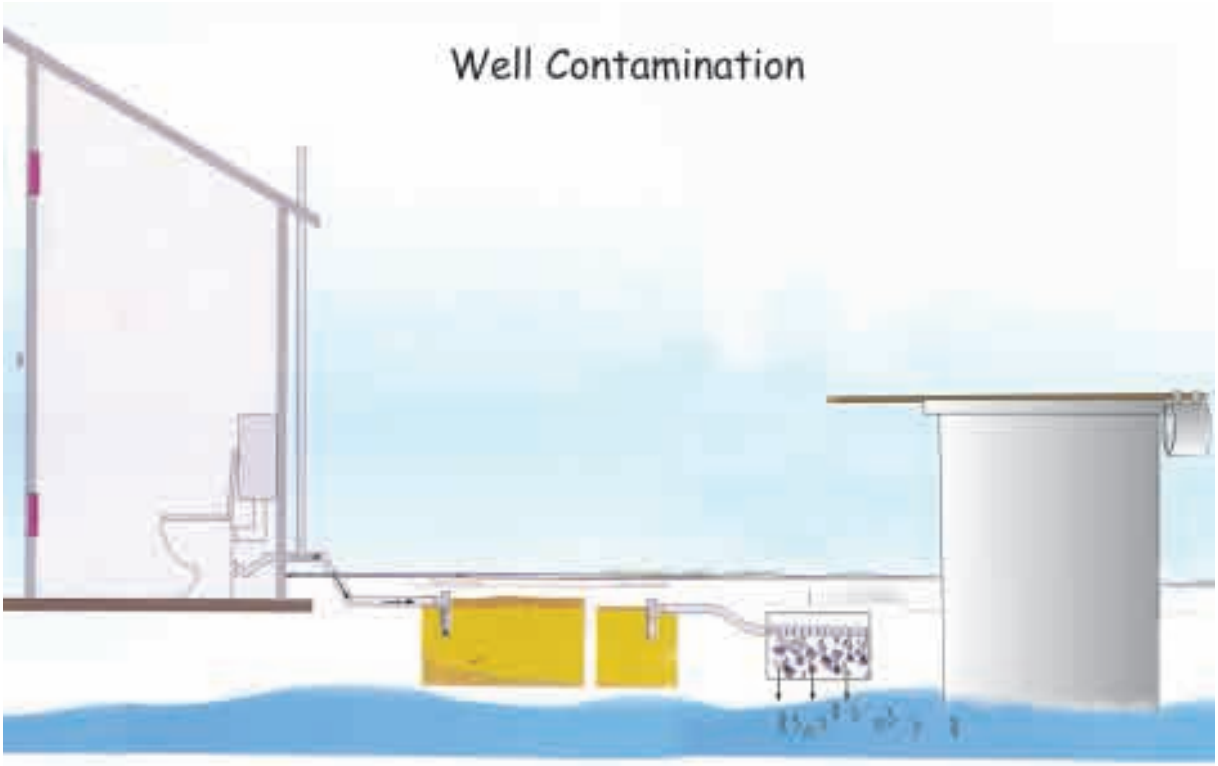
l) Store fuel oils and chemicals away from the well area.

m) If you dig a new well make sure it is near to the house and far away from the septic tank.

n) Put the rainwater tank overflow pipe into the well. Rainwater has less salt and bacteria than groundwater and contains no nitrate and ammonia. The rainwater will dilute the groundwater and improve the well water quality. It will also help keep the septic tank effluent in the groundwater away from the well.

o) Do not dispose garbage or excreta near the well (at least 15m).

p) Repair any cracks in the concrete floor around the well.



FACT SHEETS

3 SECURING RAINWATER DRINKING SUPPLIES

Rainwater provides the main drinking water supply for 99% of all households in the Maldives outside of Male'. It is the most important water for the family, as it has the most direct affect on family health.

Despite this, 70% of all households report their water tanks becoming empty in the dry season, and up to 50% of tanks tested on some islands show poor biological water quality.

If your rainwater tank becomes empty you might have to use your well water for drinking and cooking. Surveys confirm rainwater is 100 times fresher than groundwater, and 100 times cleaner than groundwater from bacteria. This is because sea water and pollution from septic tanks, fuel cans, and household chemicals cannot get into your tank, but they can and do get into your water well. Drinking rainwater will keep you healthy. Drinking well water may make you sick.

It is important therefore to make sure your rainwater harvesting is correctly sized to provide water throughout the dry season, and that you keep the roof and tanks clean.

This fact sheet tells you how to improve the amount and the quality of the rainwater you collect off your roof. Maintaining this water supply is the responsibility of the household. But you can work with your community health post to improve it.

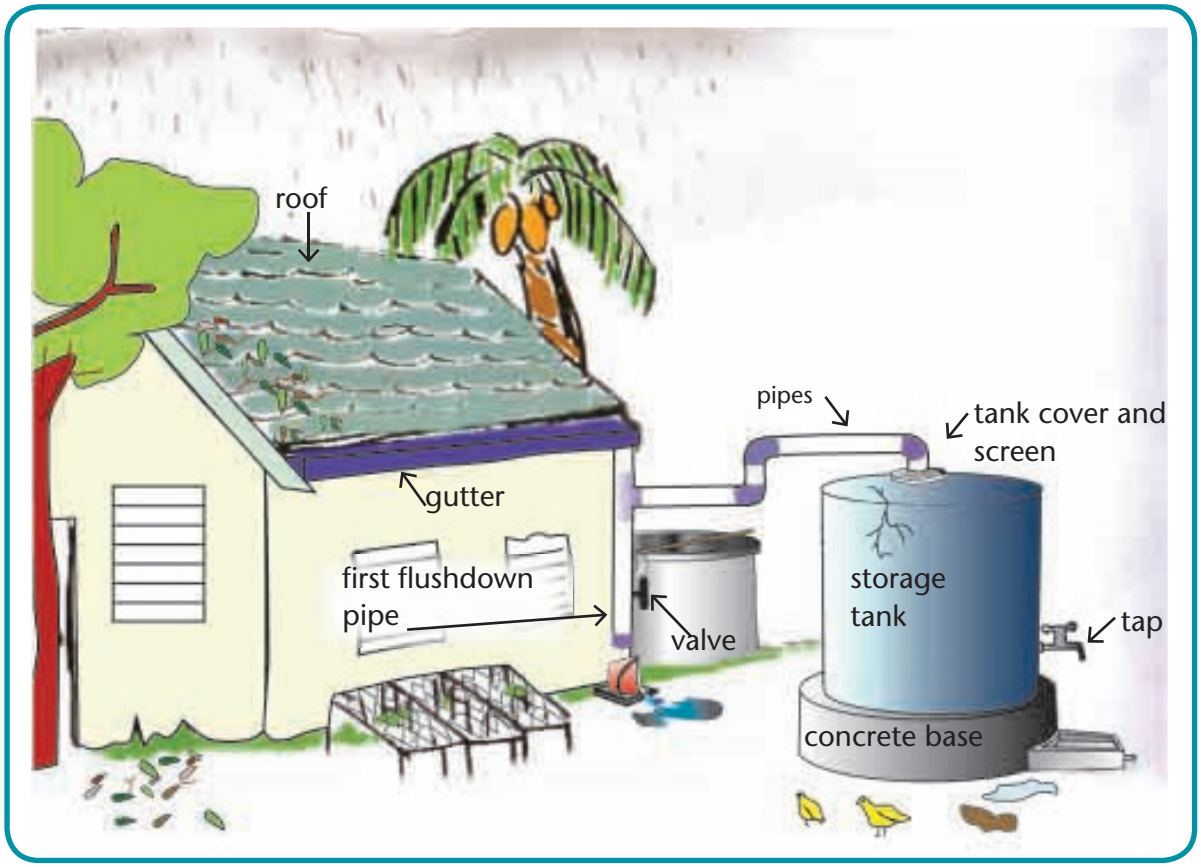
HEALTH RISKS FROM DRINKING CONTAMINATED WATER

When rain falls it is very clean and contains no bacteria and very little salt. But when it lands on your house it flows over the roof into the gutters, down the down-pipe and into the tank it picks up dirt and bacteria.

You can test your water using a special kit which can be provided by MWSA and/or your health post. The H_2S kit tests you water for bacteria. If the kit turns your rainwater sample black then you should improve the hygiene of your rainwater harvesting system using the following ideas. You can use the H_2S kit after you have cleaned the system to see if the water quality has improved. You should test your rainwater regularly to make sure you are keeping the system clean.

If the H_2S kit says your rainwater is still dirty you can treat the water you get from the tank by chlorinating it or boiling it. This kills bacteria within it.

WHAT SHOULD BE CONSIDERED WHEN HARVESTING RAIN WATER?

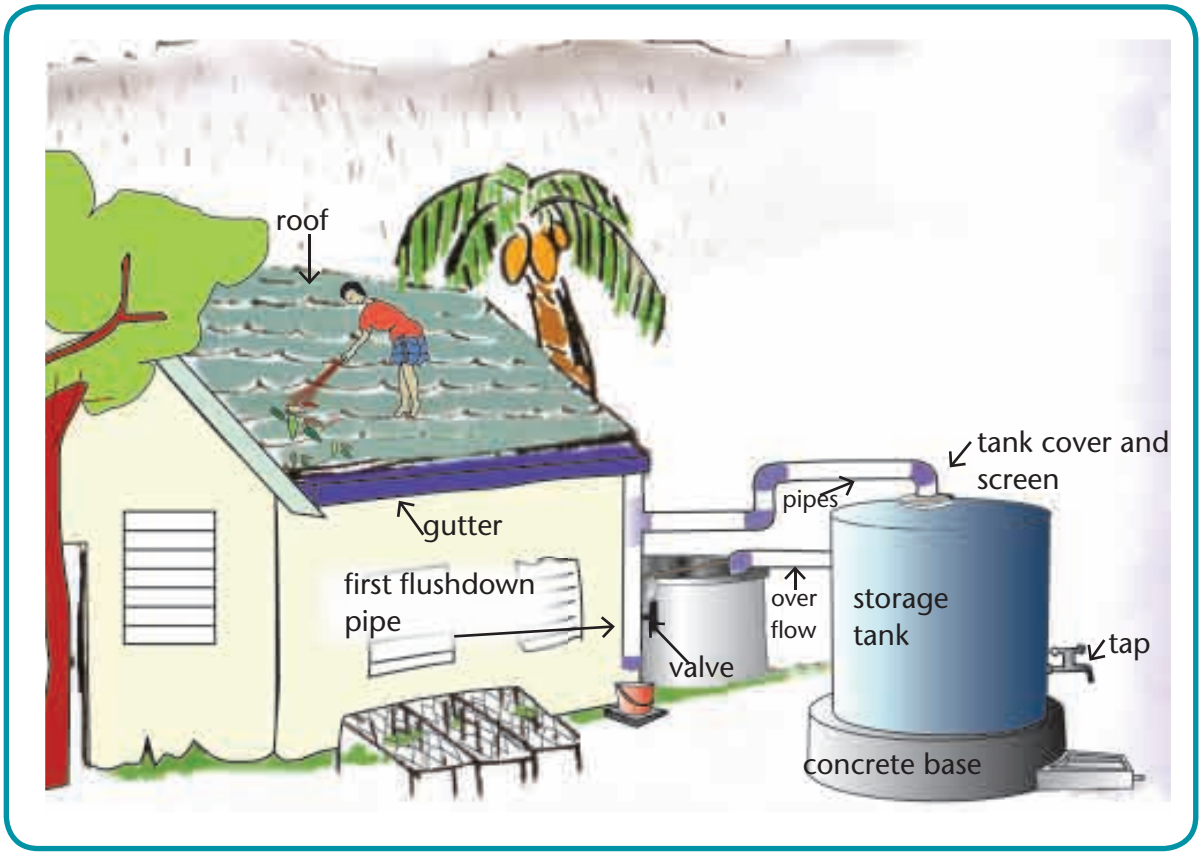


i) Clean the roof and gutters

If you keep your roof and gutters clean you will reduce the amount of dirt and bacteria going into your tank. You should clean your roof once a month, and your gutters once a week. Make sure the First Flush valve is open before you wash the roof – as you don't want wash water in the tank.

It is easier to stop the roof from getting dirty than cleaning it. Make sure no branches overhang the roof as these will attract birds, bats and insects, and allow rats to jump onto the roof. All these creatures may defecate on the roof, which will make the rainwater dirty.

FACT SHEETS



i) Put on a downpipe filter

Where your gutters empty into the downpipe, pests can also crawl. Put a small grill over the entrance to the down pipe. If you can afford some wire mesh, this will work well and also stop larger pieces of debris being washed into the tank. A filter which allows the water through but no mosquitos will be even better. Clean the filter each time you clean the gutter.

iii) Use a 'First Flush' valve

Almost all rainwater downpipes in the Maldives use a First Flush valve. This is a valve which when open prevents the water from entering the tank. You should leave this valve open, when it is not raining. When it starts to rain, let the water flow off the roof and past the open-valve for 5 minutes. This prevents the dust and dirt which may be on the roof entering your tank.

After 5 minutes close the valve and the water will flow into the tank. This water will be much cleaner than if you hadn't used the First Flush technique.

You may also like to put another filter (or cloth gauze) on the pipe just before it enters the rainwater tank. This will stop mosquitoes and other insects getting into the tank through the open end of the First Flush downpipe.

iv) Put the tank on a concrete base

It is a good idea to raise the tank off the ground by 20-30cm. This not only provides a good solid base for the tank to sit on but also raises the tank up, making it easier to use the tap and put jugs under it. Raising the tap level also tends to keep the tap itself more clean, preventing domestic animals and children from touching.

It is a good idea to have the tap not at the very base of the tank, but 10-20cm above it. This prevents the tap providing water from the very base of the tank, where debris might sink and collect. A draining tap can be put at the base of the tank to drain off any sediment collecting at the base of the tank. The draining tap also makes it easier to remove water after cleaning the tank.

v) Use a spill collector

It is very likely that water will get spilt when filling jugs from the tank. This means water falls onto the ground next to the tank and can either start to erode the sand around the base of the tank and/or pond and attract mosquitoes. Also taps can leak. Always fix a leaking tap – save water.

It is a good idea to construct a small concrete trough under the tap, which collects the spilt water and channels it away from the tank. This will keep the area around the tank dry and clean.

vi) Clean the tank

A small amount of bacteria will still get into your tank. It is necessary to clean the tank once a year. You will need to get inside the tank and scrub the walls. If you can afford bleach, then you can mix this with water to clean the tank. You should add half a bottle (about 125 ml) of 4% active chlorine bleach for every 1000 litres of water in the tank, and let the disinfected water remain in the tank for 24 hours. If the bleach is 8% you need add half the volume above. Once you have cleaned the tank you will need to drain out the dirty water before allowing the tank to refill.

Also keep the top of your tank clear from debris, especially around the hatch area.

vii) Put a filter on the overflow pipe

You should make sure your tank has an overflow pipe, so that when it is full it can fill a second tank or divert water to freshen your well. If the overflow pipe is open to the air (that is if it is not in the next tank) it should be fitted with a filter to prevent insects and small animals getting back into the tank.

FACT SHEETS

MAKING SURE YOUR TANK WON'T BE EMPTY DURING THE DRY SEASON

Whilst it is important to ensure the water quality in you rainwater tank is of as good a quality as possible, if your tank goes dry you won't have any water at all.

Recent surveys show up to 70% of all rain water tanks on islands go dry each year during the January to April dry season for up to a month or more in duration. These surveys also show that nearly all households only use half of their roof area to collect water, and some islands use less than a quarter.

Surveys also show that at least 70% of households had one 2500 litre tank or less storage volume.

Given the importance of the rainwater to each household and the poor quality of most groundwater it is important that rainwater collection is maximised. This can be done by:

i) Guttering the Entire Roof Area

Adding gutter to the rest of the roof area is very simple and costs about 10% of the value of a new tank. Increasing the rainfall collection area reduces the time it takes for your tank to refill. It is particularly helpful therefore at capturing occasional rain showers in the dry season to replenish the tank. If you double the roof area collecting rainwater from your house you can more than half the number of days the tank will be empty. For communities in the north of the country this can reduce the duration of tank empty days from 37 to 17. This does mean you will have to clean more roof area, but you'll have more rainwater.

ii) Adding a Second Tank

Adding a second rainwater tank will typically increase water storage from 2500 litres to 5000 litres per household. Many aid agencies have been providing second rainwater tanks in the last 12 months to island communities.

Having a second tank means you will have more water when the dry season starts, and are therefore likely to have water for longer into the dry season. However if you do not increase your guttering and roof catchment area as well, then the two tanks will only be replenished by the same amount as one tank being fed by the same roof area.

Doubling your rainwater storage will reduce your consecutive dry tank days by about two-thirds. But it is 10 times more expensive to buy and install a new tank than new guttering.

Ideally you should increase your guttering and your tank storage volume. This will reduce your dry tank days by 80-90%, which is about 4-6 days depending where you live in the country.

COMMERCIAL TANKS

Community tanks can be used to harvest rainwater from communal buildings such as mosques, schools and government offices. These buildings are usually some of the largest on the island. They also have low water demand as people usually work in them during the day and do not bath or wash there.

Communal tanks can be large single structures (made of ferro-cement) or a row of smaller tanks (HDPE) linked by overflow pipes. This water is very valuable as it can help the community if the household tanks become dry.

Community rainwater tanks need to be looked after the same as household tanks. In fact because the water is used less, sometimes the water quality can be poorer. This means the roof and gutters need to be kept cleaner than households. The building staff should sweep the roof every week if possible, and try to clean the roof once a month.

Because the rain water 'sits' in the tank for much longer than a household tank the condition of the tank is very important. Some communal tanks are sheltered from the weather under their own roofs, which keeps the tanks cooler, and helps reduce contamination in the tank.

Ferro-cement tanks can be difficult to clean adequately, especially old tanks. These tanks can be lined with special plastic paints, which re-seal the tank and effectively turn them into plastic tanks which generally ensure better water quality.

FACT SHEETS

4 WHAT IS A GOOD DEVELOPMENT FOR MY ISLAND?

When you consider what is a good development for your island you need to consider certain constraints which the island has to overcome or address. These include:

The limited amount of freshwater available on the island;

- The limited appropriately skilled people on the island;
- What the island can afford to pay both to buy the system but also operate and maintain it;
- How the new system will be managed.

i) Community Involvement

It is essential that you as a community are involved in deciding what water supply and sanitation options you want. You will have to pay for it (at least its operation and maintenance), you will have to operate it and maintain it, and you will have to decide how to collect payments and what environmental impacts you consider are acceptable and what are not.

If the systems are to be sustained over the long term for the benefit of your community, you need to get involved with the decision making early in the design of the water and sanitation projects.

ii) Existing Water Supply and Sanitation Systems

It is important to remember that nearly all island communities presently operate household systems at the moment. The drinking water comes from rainwater harvesting, the non-drinking water from the house wells, the wash wastewater is disposed into a catchpit within the house plot and the toilet water into a septic tank which overflows into the ground within the house plot.

These systems are operated by the household, they cost very little to operate and maintain – usually just time and effort, and the consequence of the systems failing immediately affects the household, so they do maintain them.

Whilst these systems can be significantly improved, they have worked well for many years.

iii) Introducing Communal Schemes

Communal schemes include both water supply (groundwater abstraction galleries and desalination plants) as well as sewerage systems.

a) Advantages

- If operated correctly, these systems can have the following advantages:
- Water Supply Schemes
- Fresher water than some water wells
- Greater reliability of supply compared to rainwater harvesting
- Higher levels of treatment and better water quality
- Improved human health
- Easier protection of the water source e.g. groundwater protection areas
- Sewerage systems
- Removal of sewage from the freshwater lens
- Reduced bacterial and nutrient contamination of groundwater
- Easier introduction of sewage treatment and disposal
- Improved human health
- Reduced environmental damage.
- However in order for these systems to be operated effectively they require:
- Technically competent operators
- Regular fees from all households, at much higher rates than people are use to paying
- Management teams to run the equipment, collect the bills, repair the system.

b) Disadvantages

- If the systems are not designed correctly then there may be the following impacts:
- If they take more groundwater than the freshwater lens can provide the freshwater lens will become saline.
- If there is no sewage treatment raw sewage will be disposed of in the sea or on the land.
- Inadequately qualified staff to maintain the system.
- Costs for operation & maintenance may increase with time as equipment gets older.

FACT SHEETS

iv) Available Water Supply Technologies and Comparable Costs

It is generally true to say that the more complex water supply technologies provide better water quality, are more difficult to maintain, have larger operating costs, and are more expensive. They are also more likely to go wrong, and therefore not provide better water quality than simpler technologies.

Water Supply technologies in order of increasing cost and complexity are:

- Rainwater Harvesting
- Household Water Wells
- Community wells (e.g. mosque wells)
- Communal groundwater (infiltration gallery) and distribution system
- Desalination Plant and distribution system

The costs of rainwater harvesting and household water well water supplies will be well known to island households, the former being essentially labour only, the latter fuel costs for the pump and spare parts. These technologies have been practiced for many years and whilst they can be improved they have been effective. Domestic well operating costs including fuel usage and pump replacement are estimated at US$0.2/m3.

Operational costs for the communal groundwater system will be marginally similar, and have been estimated in other atoll countries at US$ 0.5/m3. Such systems have been used widely in atoll countries across the Pacific Ocean.

Current purchase prices for desalinated water in Male' are Rf7.2/liter. It is likely production costs would be greater in the outer islands where operation and maintenance costs will be greater per person.

v) Available Sanitation Technologies and Comparable Costs

There is a very large list of possible sanitation technologies which are being considered for the island communities. To date, only septic tanks have been successful, but even these have largely failed to prevent groundwater contamination, primarily due to poor design and construction, and negligible maintenance. Addressing these issues is even more important for more complex technologies.

As with water supply technologies it is generally true to say that the more complex sanitation technologies provide produce better wastewater quality for disposal and have less environmental impact, but are more difficult to maintain, have larger operating costs, and are more expensive. They are also more likely to go wrong, and therefore not provide better wastewater quality than simpler technologies.

Sanitation technologies in order of increasing cost and complexity are:

- **Septic Tanks** – essentially operated by the households but dispose of effluent into groundwater
- **Small Bore Gravity Sewerage Systems** – requires septic tanks but moves effluent off the island
- **Pumped Sewerage Systems** – doesn't require septic tanks but has fuel costs and pumps to maintain
- **Vacuum Sewerage Systems** – as pumped systems but requires higher levels of design, operation & maintenance to ensure vacuum is maintained.

The treatment options also have a range of complexity, with associated operation & maintenance costs.

Primary involves removing the bio-solids only, with the raw effluent then being discharged. Secondary treatment removes much of the nutrient loading. Tertiary Treatment is intended to allow re-use of the wastewater and is essentially clean water. Tertiary treatment is rarely used anywhere in the world.

After treatment (if any is proposed), the effluent can be disposed to either the land in soakage pits or deep in boreholes, or being pumped offshore through sea outfalls. Soakage pits are cheapest, while properly constructed outfalls are most expensive.

vi) Alternative Approaches

There are also a number of alternative approaches, which all focus on reducing water demand and usage, which therefore resulting less water abstraction and less sanitation disposal. These include:

Dry or Compost Toilets – which use no water and produce a compost, resulting in no groundwater contamination

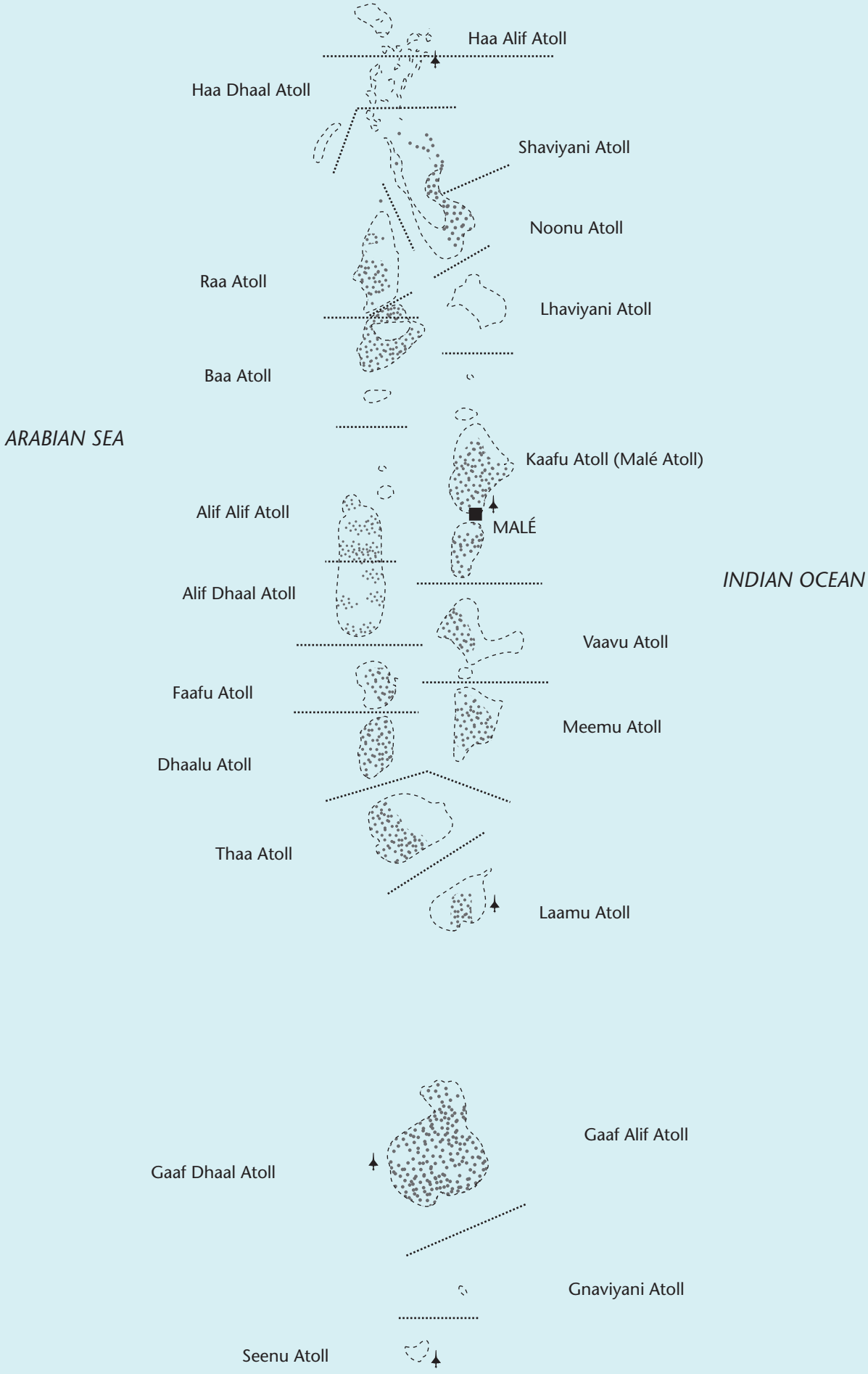
Grey water Re-Use – putting the washing water back in the ground to maintain the freshness of the aquifer

Water Conservation – reducing demand through public awareness and education, tank leakages etc.

vii) Essential Questions to ask

This is a list of essential questions you should ask yourselves and the designers of any proposed water supply or sewerage system:

1. Has a water resources assessment been carried out of our island? If not ask MWSA.
2. How much groundwater can the island provide and what supply or sanitation options does this make sustainable?
3. What will be the environmental impact on the freshwater lens and existing water supplies?
4. What will be the environmental impact on the coastal fisheries and water quality?
5. How much will it cost to operate and maintain the system?
6. How much will we have to pay per household?
7. Can the community afford to pay this much?
8. How long is the system designed to work for?
9. How many people is it designed to work for?
10. How will the system be managed – by community, by a service provider?
11. How will the community get adequate training to run the system?
12. What happens when the equipment breaks down and we can't repair it?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needs to know the sea
to catch the fish

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