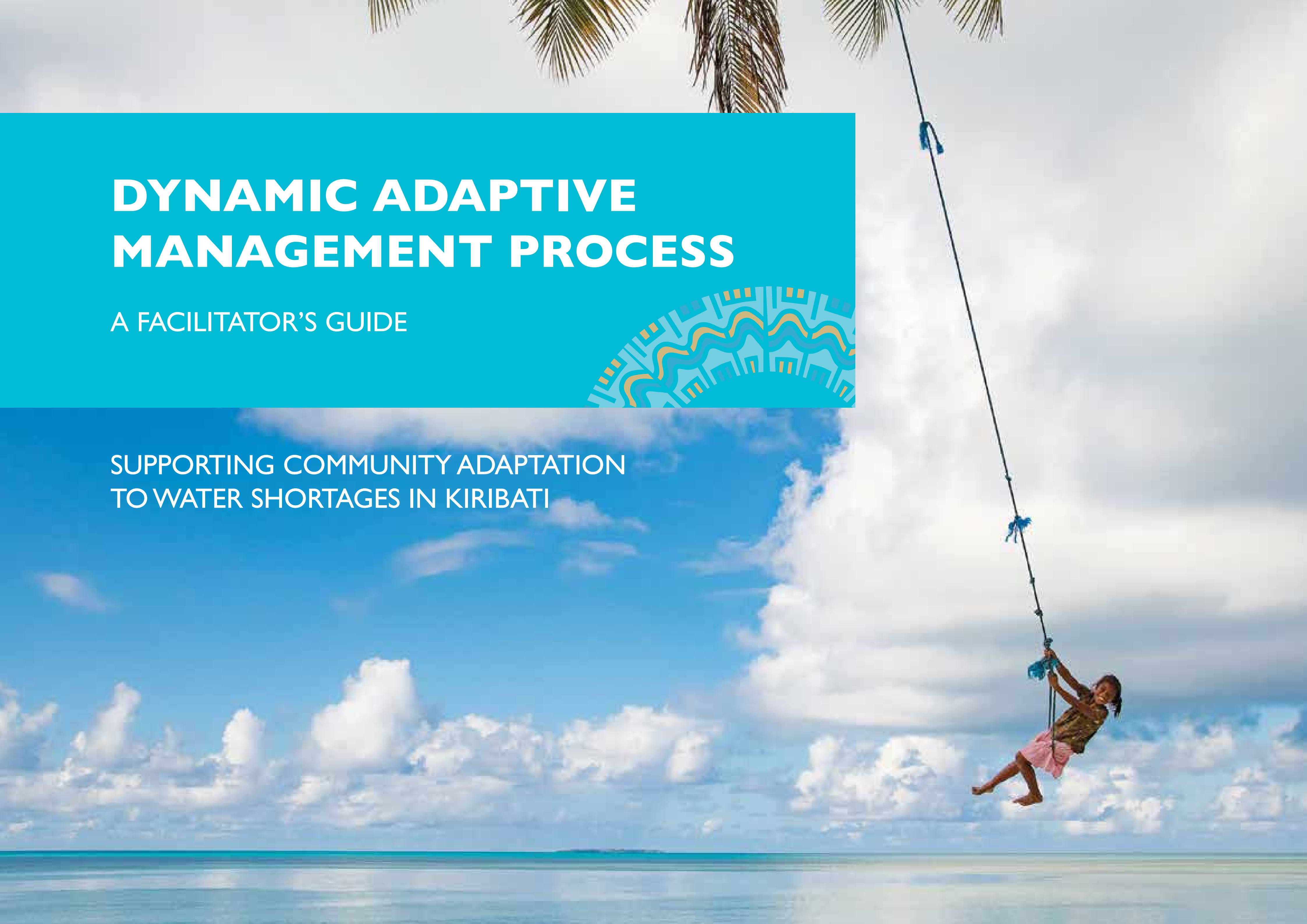


DYNAMIC ADAPTIVE MANAGEMENT PROCESS

A FACILITATOR'S GUIDE

SUPPORTING COMMUNITY ADAPTATION
TO WATER SHORTAGES IN KIRIBATI

February 2016

The Dynamic Adaptive Management Process (DAMP) handbook is a major output of the project ***Supporting Community Adaptation to Water Shortages in Kiribati.***

This handbook is based on a two-day training workshop which focused on the adaptive management of community based water resources in Kiribati. The workshop was held in Tarawa and was facilitated by researchers from the Institute for Sustainable Futures, based at the University of Technology Sydney with members of the Kiribati Climate Action Network (KiriCAN). The workshop was funded by USAID through the Pacific - American Climate Fund (PACAM).

The handbook should be cited as follows:

Mukheibir P and Boronyak-Vasco L. (2016) *Dynamic Adaptive Management Process - Supporting Community Adaptation to Water Shortages in Kiribati.* Prepared for USAID (PACAM) by the Institute for Sustainable Futures, University of Technology Sydney, Australia.

Cover photo credit Darren James

GLOSSARY OF TERMS

Capacity	Competence (skills, knowledge and confidence) to address challenges.
Climate change	A significant change in the average weather conditions or a change in the distribution of weather events. Likely to happen over an extended period (typically decades or longer). For example, greater extreme weather events.
Climate change adaptation	Action taken to avoid actual or likely impacts from climate change. Actions include planned response to managing climate change risks as well as taking advantage of the opportunities a changing climate could provide.
Criterion	A standard that is used for judging something or for making a decision about something. Criteria is the plural form of criterion.
Drinking/potable water	Water that is clean and safe enough for drinking, hand washing and cooking.
Exposure	The degree to which a system or sector is exposed to climate-related impacts, including the duration, frequency, and magnitude of changes in average climate and extremes.
Impacts (climate)	Consequences of climate change on natural and human systems.
Indicator	A sign that shows or suggests the state or existence of something.

Multi-criteria assessment (MCA)	A tool that can aid decision-making in complex situations. It provides a structured and transparent way of analysing complex issues and selecting between competing options.
Response options	Planned or unplanned actions in response to climate-related impacts.
Safe drinking water	Water that will not harm you if you come in contact with it. To be safe, the water must have sufficiently low concentrations of harmful contaminants to avoid making people sick who use it.
Sensitivity	The degree to which a system is sensitive to change.
System	A population or ecosystem; or a grouping of natural resources, species, infrastructure or other assets.
Storm surge	A rise above the normal water level along a shore resulting from strong onshore winds that accompany a tropical cyclone as it comes ashore.
Trigger	A limit that suggests it is time for alternate action
Vulnerability	The propensity or predisposition to be adversely affected by climate change. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.
Water security	The reliable availability of an acceptable quantity and quality of water for health, livelihoods and production, coupled with an acceptable level of water-related risks.

CONTENTS

INTRODUCTION

What does the handbook do?

This handbook aims to build the skills which community facilitators need to lead participatory decision-making processes such as workshops to plan for the delivery of basic services under a changing climate. It provides facilitators with a range of tools for leading conversations at the community level. It will also help to build skills and knowledge which will enable the community to participate in identifying solutions that are relevant and appropriate for their context.

The handbook provides an outline of how to:

- Do a simple multi-criteria analysis (MCA) of viable water supply response options
- Better understand the impacts of climate change on these possible water supply options
- Identify indicators that show when a new water option should be

While the handbook focuses on the adaptive management of drinking water resources, the tools and processes that are presented are flexible enough to be applied to a range of situations.

The MCA approach presented here can be used to aid decision-making in complex situations in which multiple objectives and viewpoints are considered. The process involves selecting assessment criteria and then rating each option against those criteria. It provides a structured and transparent way of analysing complex issues and choosing between competing options.

The tools in the handbook can assist in planning for future uncertainty at the local level. In this case, we look at the impacts of climate change but the tools are also relevant to other drivers, such as population changes.

Who should use the handbook?

Community facilitators from non-government organisations, local and national governments; and service providers will find the processes described in this handbook useful to work with local communities and committees to identify and plan adaptation responses to climate change impacts.

Why do we need to plan for safe drinking water?

Water is a natural resource that is critical for socio-economic development, healthy ecosystems and human health and wellbeing. Access to safe drinking water and sanitation has been recognised by the United Nations General Assembly as a human right that is essential to the full enjoyment of life and to all other human rights (UN Resolution, 64/292). However, the pressure on safe drinking water resources is increasing due to the combined effects of population growth, urbanisation, economic development and climate change.

How can we manage water under a changing climate?

Climate is a key factor in determining available water supplies for most towns and cities. Climate change is projected to increase global average temperatures and alter critical climate variables, including rainfall and evaporation, over the coming decades. This may result in changes in natural climate variability and to the frequency and severity of extreme events, such as floods and drought. However, there is uncertainty about future climate impacts. In some regions, climate change may significantly reduce water supplies available from traditional sources, yet other regions may see increasing levels of available supply. This uncertainty means that water supply and demand planning will need to become more capable of adapting to changing circumstances while working towards reducing the vulnerability of water systems to climate change (UNDSEA, 2008).

Adaptation is a process of continual change in response to climate and non-climate drivers. Responses can focus on decreasing the vulnerability of water systems to climate change, for example by increasing the diversity of water sources, or responses can focus on increasing the adaptive capacity of stakeholders, for example by raising awareness of the indicators or clues that show that the drinking water is not safe to drink and another source of water needs to be used.

How you use the handbook

Since it is not possible to accurately predict how and when future climate change will impact on drinking water supplies, it is important to start planning for new water supplies now. This is so that a water supply plan can be implemented quickly to minimise water shortages when drinking water supplies are affected by climate-induced impacts. The tools and processes outlined in the handbook can assist in decision-making for water planning.

The handbook has two key sections:

- Water supply options selection
- Understanding and responding to the impacts of climate change on water supplies.

Each section provides some background information, the processes involved and why we include them, a description of the methods and tools used to carry out each of the processes, as well as examples from a training workshop on water resources held in Tarawa, Kiribati. You can use the processes described to inform your own workshop and lesson plan.

The handbook activities have been designed to allow for individual learning, as well as participation in small and large group activities fostering peer-to-peer learning and collaboration through the learning-by-doing approach.

While the examples in this handbook refer to securing adequate safe drinking water supplies under a changing climate, the processes outlined are relevant for planning adaptive management to risks in other sectors as well.

Aim:

To identify the most appropriate water supply option/s based on clear criteria that are important to the community.

Steps:

The workshop can be organised as a series of facilitated sessions as shown in Appendix 2, and is broken into the following sessions:

Session 1: Map your village

Session 2: Identify water supply options

Session 3: Identify and prioritise the selection criteria

Session 4: Rank the water supply options

OPTIONS SELECTION

Choosing viable water supply options to manage a shortage or a disruption to the supply of safe drinking water can be challenging when faced with different perspectives and motivations within a community-based committee. Having a set of criteria helps to choose among a number of different options. This allows for a clear and considered way of finding solutions that can be supported by the majority of the participants.

The multi-criteria assessment (MCA) tool is helpful in deciding between options because it seeks to find a balance between different people's needs and what they consider to be important. The tool provides a way to think about a wide range of issues and then provides a way for ranking the options or combinations of options.

Background – basic water supply requirements

According to the World Health Organisation (WHO), a person requires at least 50 litres (L) of potable water per person per day (p/d) to meet basic needs:

- drinking (more than 5 L/p/d)
- hand washing and food preparation (15 L/p/d)
- laundry and bathing (20-30 L/p/d).

When planning for water supplies we need to consider a wide range of possible water supply options which could satisfy different types of domestic demands, such as drinking or cooking which require the water to be safe to drink. Otherwise people can become ill.

For other uses of water such as washing clothes, the water does not need to be as clean. This handbook focuses on drinking water supplies.

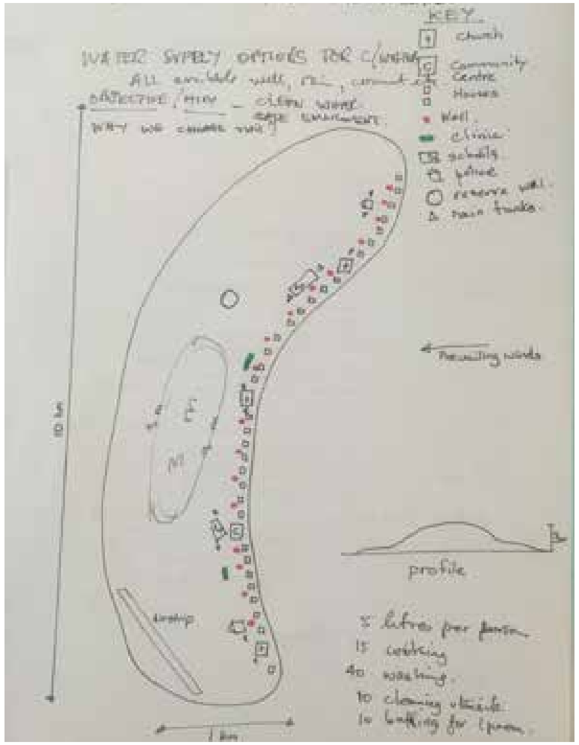
SESSION 1

MAP YOUR VILLAGE

To create a shared understanding between the workshop participants (and the facilitator), participants are given the opportunity to describe and map their village and community. This should include mapping the location of houses and communal infrastructure, government buildings, water sources, areas prone to storm surges and flooding, etc.

This activity is a conversation starter as well as a resource that provides information and enables understanding for the participants and facilitator. It also allows the participants to visualise their community and resources such as metal roofs to capture rain water. It also provides useful contextual information for undertaking the activities that follow.

Figure 1: Example of community mapping



WORKSHOP ACTIVITY: MAPPING YOUR VILLAGE

EXPECTED OUTCOME

A map that shows the village's main buildings, water sources, roads and areas prone to flooding or sea level rise.

PREPARATION

Draw the shape of the island and key features of the island on a large piece of paper and stick it up on a wall.

PROCESS

- The participants discuss and describe their village and island.
- They should use coloured pens to draw their village/island or surroundings, depicting key features, such as buildings, water sources, roads, areas prone to flooding etc.

TIPS & TRICKS

Depending on the number of participants, this activity could be done in smaller groups to allow more interaction between participants.

If the workshop contains representatives from a number of villages, you could skip the mapping part, and have a general discussion based on the toopics listed in the box.

TIMING

30 mins

MATERIALS

- large flip chart paper
- colour pens

Topics for Discussion

- Size of island
- Population
- Households
- Churches
- Community centres
- Location of houses
- Height above sea level
- Main occupation/livelihood
- Weather and climate
- Sources of water
- Sanitation
- Health
- Current water use

SESSION 2

IDENTIFY WATER SUPPLY OPTIONS

To identify viable drinking water supply options, participants need to:

1. Understand the problem/s that they are responding to
2. Generate a wide range of options in response to the problem/s for further consideration later.

Understanding the problem

Participants should be allowed the opportunity to share their experiences and knowledge about the reliability of their water supplies in terms of quantity and quality. The World Health Organisation suggests 20 litres per person per day for drinking, hand washing and cooking. Facilitators can use the impact of past weather events such as a big storm on drinking supplies as a good illustration of how water supplies might be affected by climate change in the future.

WORKSHOP ACTIVITY: UNDERSTANDING THE PROBLEM

EXPECTED OUTCOME

A description of the current drinking water situation in the participants' community and the current threats to their supply of safe drinking water.

PREPARATION

- Prepare a brief PowerPoint presentation based on the available statistics for the community on the population size, available water supplies, volumes of drinking water used, etc.
- Or prepare printed fact sheets to distribute in the workshop.

PROCESS

- Present the background information
- Allow time for discussion and sharing of past experiences. Ask some prompting questions such as:
  - Where do you currently get your drinking water from?
  - How was this source affected during the last drought or storm surge?

TIPS & TRICKS

Keep the presentation short, and allow the participants to share their own knowledge and experience.

TIMING

30 mins

MATERIALS

- PowerPoint presentation or printed fact sheets

Generating potential options

Participants should be invited to come up with a wide range of potential water supply options to address current or potential shortfalls in quantity or deterioration in quality. All options that provide an adequate volume of potable water (20L/p/d) should be identified – nothing should be ruled out at this point. Options could include supply technologies (such as pumps), behaviour change (not wasting water) and infrastructure to protect existing water supply sources from weather-related damage (such as protecting a groundwater well).

Table 1:
Example of a list of drinking water supply options

- Communal rainwater tanks
- Water pumped from an inland source
- Desalination plant
- Buying bottled water
- Household rainwater tank
- Solar disinfection bottle (SODIS)
- Hand/solar pump
- Household wells

WORKSHOP ACTIVITY: GENERATING AN OPTIONS LIST

EXPECTED OUTCOME

At the end of this session there will be one list of all of the water supply options that participants have identified.

PREPARATION

Prepare a list of potential water supply options that you can use to prompt the discussion, see Table 1.

PROCESS

- Split the workshop into small groups of about 4-5 participants.
- Participants list all the potential drinking water supply options they can think of on a piece of flip chart paper.
- Each group reports back to the whole room on their list of drinking water supply options.
- While the groups are reporting their lists, compile a summary list of options on flip chart paper.
- Once the full list has been generated, go through each option and ask the question: "Does it provide enough water as per the WHO guidelines? (see page 4)
  "Does it provide clean water for drinking? If the answer is "No" the option should be struck from the list.

TIMING

40 mins

MATERIALS

- a large piece of flip chart paper per group
- pens

TIPS & TRICKS

Allow the first group to present their full list of options. Subsequent groups can then add any additional ideas to the list.

SESSION 3

IDENTIFY AND PRIORITISE THE SELECTION CRITERIA

The aim of the next two sessions is to facilitate community participation in decision making, to judge the best options using more than one selection criterion. This process is known as multi-criteria analysis (MCA). In this session stakeholders participate in both the selection and the valuation of the selection criteria.

Choosing between the options identified in the previous session will involve making trade-offs between the options. Often, cost is the only consideration. However, other criteria should also be considered – these could include factors that affect people in the community, the use of the technology, the impacts on the environment, and the money needed to buy, build, operate and maintain particular options.

We can use four categories to help us think of the things we value in a good water supply system, and these can be useful for making a decision on the best option/s for the community. See the table below:

Table 2 :
Four key categories for identifying selection criteria

People: The social impacts of the water supply option such as reliability under changing weather conditions, accessibility (distance to access water) and safety considerations when accessing the water.

Technology: Technological considerations of the water supply option such as: Is the technology easy to operate and maintain? For example, a hand pump. How much training or knowledge would a person need to operate, maintain or repair the water supply technology and are spare parts available locally?

Environment: Do the different sources of water have a positive, neutral or damaging impact on the surrounding environment? (e.g. Does the water supply option require high energy inputs to operate? Does it pollute the air?)

Money: This is the cost to buy and install the option (up-front costs) as well as costs to operate and maintain (ongoing costs) or the costs of buying water.

In some instances, criteria can be used to set a minimum requirement for all options and could be used to remove options from the list if they do not meet the required standards. Options that are unable to meet the minimum drinking water supply criterion (5 litres per person per day) or water quality standards, should be ruled out at this stage.

The criteria should help you choose between the features of each of the options. In this case, it is also important to ensure the final set of criteria:

- are relevant to drinking water supply options
- are useful for choosing among options rather than providing the same answer for almost all the options being considered e.g. good quality water.
- do not overlap with each other (e.g. using both energy consumption and Green House Gas (GHG) emissions as criteria could result in double counting since they are closely related to each other).

Participants may have different opinions about the importance of each selection criterion, so all criteria should not be considered equal. If we consider all the criteria as having equal importance, less important criteria will have undue influence over which of the options is judged the best. Therefore, it is useful to prioritise the criteria from most preferred to least preferred, and to assign a weighting based on the number of votes they receive. Weighting a criterion means making a value-based decision as to how important it is in relation to each of the other criteria.

EXAMPLE

When choosing a new fishing boat, we need to think of a number criteria, and make a trade-off between them to make a decision on which boat to choose, such as:

- The cost of the boat
- The size of the boat
- The material used for the construction of the boat
- The energy source to power the boat e.g. row boat vs. motorised or sail.

WORKSHOP ACTIVITY: IDENTIFYING SELECTION CRITERIA

EXPECTED OUTCOME

A list of the top 5 most important selection criteria for prioritising the water supply options. This will be used in session 4.

PREPARATION

For each group, prepare a large piece of flip chart paper with four squares – one for each of the four categories: People, Technology, Environment, and Money, see Figure 2.

PROCESS

- Work in small groups of 4–5 participants.
- For each of the four key categories each person writes one criterion on a sticky note. The criterion is something that they value in a drinking water supply.
- Participants place their sticky notes under the appropriate categories on the large flip chart paper. Refer to Figure 2
- Participants discuss and group similar criteria.
- Ask the group to consider whether any criterion might be missing from those they have listed, and remove any that relate to quality or quantity.
- The group rewrites their final list of criteria on the A4 paper provided (one criterion per sheet).
- The first group presents their list of criteria and sticks them on the wall. When the next groups presents their criteria, they only add criteria that are different to those already on the wall.
- Ask the whole workshop group to discuss the criteria on the wall. Ask prompting questions such as: Are there any criteria that are surprising? Are there any that are missing?
- Each participant is then given 5 dots to vote on the criteria. They can place one or more dots on any criterion they think is important - more dots equals more importance.
- Once everyone has voted, count the dots for each criterion.
- Order the criteria from most important (the one the most dots) to the least important.
- Confirm with the group the prioritised selection criteria and lead a group discussion about the top five criteria and the number of votes they each received.

TIPS & TRICKS

If stickers are unavailable then voting can be done by making crosses on the A4 paper

TIMING

90 mins

MATERIALS

- A large piece of flip chart paper
- Pens
- Sticky notes
- A4 pieces of papers
- sticky dots or stickers

Figure 2: Grouping the selection criteria

EXAMPLES OF CRITERIA

- Safe for the environment
- Reliable supply
- Easy to access (within close walking distance)
- Ease of use
- Affordable
- Easy to maintain

Figure 3: Voting for the selection criteria

SESSION 4

RANK THE WATER SUPPLY OPTIONS

This session outlines the MCA process. This process can help to identify the most preferred water supply options based on the community's selection criteria that was identified and ranked in session 3.

How to do a weighted multi-criteria assessment (MCA)

In order to choose the most preferred options, participants need to order the options against each criterion, from best to worst.

Each option is then given a score to reflect how well it compares to the other options for each criterion. For example, if there are eight options, the best option receives a score of 8, while the worst receives a score of 1.

To account for the criteria preferences from Session 3, the number of votes each criterion received (called the weightings) are included in the calculation. This is done for each option by multiplying the score it receives under a criterion by the weight of that criterion to provide a weighted score.

The weighted scores for each option for all the criteria are then added up to reveal on overall score for each option. The option with the highest score is considered the most preferred (as shown if Figure 4).

How to do a simple multi-criteria assessment (MCA)

For some participants the weighted MCA approach can prove to be a complicated concept, in which case it may be sufficient to use a simplified approach without applying any weighting (as shown in Figure 5). While less accurate, the process will still allow the participants to get a feel for which options scored best overall, and will provide an opportunity to discuss any surprises that are revealed.

For this approach only use the top 3 or 4 criteria for the ranking of the option (see Fig 5.)

WORKSHOP ACTIVITY: RANKING THE OPTIONS

EXPECTED OUTCOMES

1. A prioritised list of water supply options for use in Session 8.
2. The participants obtain a basic understanding of how to use MCA as a tool when making complex decisions about water supplies.

PREPARATION

- Write one option per A4 sheet from the summary list of options developed in Session 2.
- Write each of the top five criteria on an A4 piece of paper.
- Prepare a table (on piece of flip chart paper) with the criteria listed along the top of the table and the water supply options down the side.

PROCESS

- Participants work as a whole group.
- Undertake the following process for each criterion in turn:
  - Place the A4 paper with the criterion name on an open space of floor.
  - Place the A4 papers with the options written on them below the criterion (in no particular order).
  - Ask the participants to order the list of options from best to worst performing against the first criterion.
  - Repeat and record the ranking of the options on the table (See Figure 4) for each criterion.
- Calculate the combined score for each supply option using either the simple or weighted MCA method.

TIPS & TRICKS

For a workshop of more than 15 participants, use smaller groups to work through all the activities. The ranking scores of the groups for each option will then need to be added together to calculate the total score.

TIMING

60 mins

MATERIALS

- A large piece of flip chart paper
- A4 paper
- blue tack (or sticky tape)
- pens
- calculator

Figure 4: Example of Multi-Criteria Assessment with weighting

Criteria	Safe for the environment		Reliable		Walking distance		Cost		Easy to maintain		Score	Ranking
Votes for each criteria	(7)		(14)		(3)		(14)		(12)			
Weighted scores for the options=votes for each criteria * the ranking number for the option (Ranking number of the options shown in brackets below)												
Communal RWT	(4)	28	(2)	28	(4)	12	(4)	70	(4)	48	**186**	**4**
Desalination	(1)	7	(7)	98	(3)	9	(1)	14	(1)	12	**140**	
Household RWT	(7)	49	(3)	42	(5)	15	(5)	56	(5)	60	**222**	**3**
Inland well	(5)	35	(6)	84	(1)	3	(3)	84	(3)	36	**242**	**2**
Water pump	(3)	21	(4)	56	(6)	18	(2)	42	(2)	24	**161**	
Buying bottled water	(2)	14	(1)	14	(2)	6	(7)	28	(7)	84	**146**	
Household well	(6)	42	(5)	70	(7)	21	(6)	98	(7)	72	**303**	**1**

Figure 5: Example of Multi-Criteria Assessment with no weighting

Criteria	Reliable	Cost	Easy to maintain	Score	Ranking
Ranking of the options shown below					
Communal RWT	2	5	4	**11**	**4**
Desalination	7	1	1	**9**	
Household RWT	3	4	5	**12**	**3**
Inland well	6	6	3	**15**	**2**
Water pump	4	3	2	**9**	
Buying bottled water	1	2	7	**10**	
Household well	5	7	6	**18**	**1**

Aim:

1. To understand how climate change might affect your water supplies and the implications for health and wellbeing in the community.

2. To identify the triggers that indicate when to plan the next adaptation response.

Steps:

Session 5: Climate trends and projections

Session 6: Mapping the impacts on water supply and demand

Session 7: Indicators of change

Session 8: Responding to the indicators

UNDERSTANDING AND RESPONDING TO THE IMPACTS OF CLIMATE CHANGE

This part of the handbook focuses on the current and future climatic impacts on drinking water supplies, how to respond to these impacts, and identifying indicators that will alert communities when new drinking water supply options need to be implemented.

SESSION 5

CLIMATE TRENDS AND PROJECTIONS

In this session the historic climate trends for temperature, rainfall, sea level rise and storm surges over the past 50 years should be presented.

This should be followed by a presentation of the predicted changes for next 30–50 years based on the Inter-governmental Panel on Climate Change (IPCC) emissions scenarios. - see Appendix 1.

WORKSHOP ACTIVITY: CLIMATE TRENDS AND PROJECTIONS

EXPECTED OUTCOME

A common understanding of the historical climate trends and the projected climate change for the village or island.

PREPARATION

Prepare a brief presentation of the available information on historical and projected climate trends for the local area.

PROCESS

- Present the historical climate information using PowerPoint or the printed fact sheets.
- Ask the participants to share their experiences of climatic conditions in the past e.g. storm surges from storms or high tides, flooding or drought? The areas that have been impacted should be noted on the map prepared in Session 1.
- Ask some prompting questions such as: Do you think storm surges are increasing? Do you think rainfall is increasing or decreasing?
- Present the projected climate trends for the local area.
- Invite some discussion by the participants.

TIPS & TRICKS

Keep the presentation short, and allow the participants to share knowledge and experiences.

TIMING

30 mins

MATERIALS

- PowerPoint presentation or printed fact sheets for sharing with the participants

Table 3: Future climate projections for the Gilbert Islands

	2030	2045
Average annual rainfall	Increase by 8% on 2015 rainfall	Increase by 15% on 2015 rainfall
Average annual temperature	Increase by 0.3 degrees (0.5%) Increase in number of hot days	Increase by 0.7 degrees (0.9%) Further increase in hot days
Mean Sea Level	+30mm	+150mm
Storm surges	Increase in storm surges	Increase in storm surges

SESSION 6

MAPPING THE CLIMATE IMPACTS ON WATER SUPPLY AND DEMAND

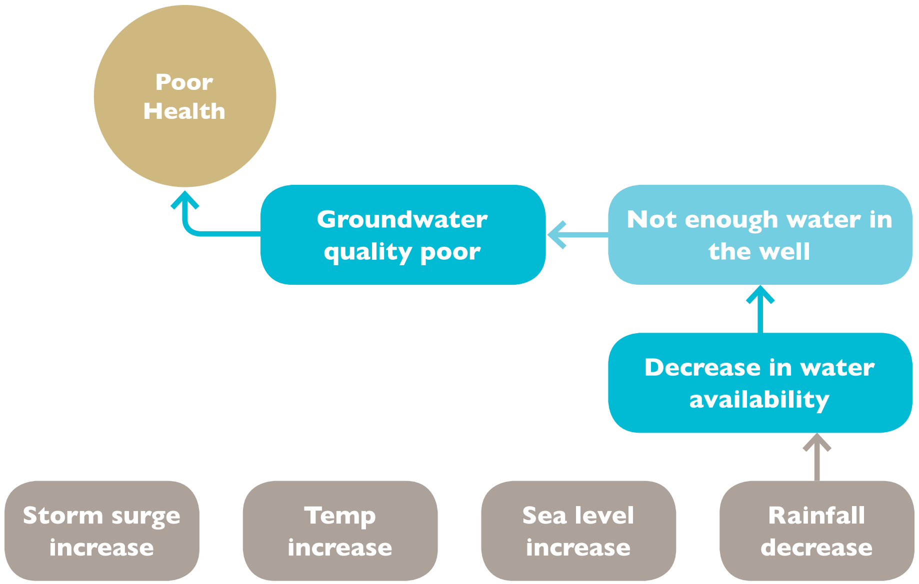
Understanding how climate variability and extreme events (such as big storms) will affect water resources and the community's health is important when planning and implementing adaptation responses. An impact map is a useful way to see these links.

By considering the consequences of an impact such as rainfall decrease (for example), participants are able to map the follow-on impacts related to the change in the situation, as shown in Figure 6.

Asking the question "What does that impact cause?" will allow the participants to think of the next logical impact until they arrive at the most critical impact which relates to heath and/or wellbeing.

Communities can never know exactly how and when the projected impacts of climate change (presented in the previous session) will affect their drinking water supplies. Participants are therefore provided with a scenario that indicates the direction (increase or decrease) of the climate-related impacts for that region. The scenario should also describe how this could in turn affect drinking water resources.

Figure 6: Example of an impact map for rainfall decrease



Below are descriptions of two scenarios that can be used to aid thinking about the chain of impacts on water supply and demand.

Rainy scenario

- More rainwater for capture and groundwater recharge. 10% rainfall increase = 7% increase in groundwater recharge, and 20% increase = 10% increase in groundwater recharge.
- An increase in the number of hot days will increase water demand, but not significantly.
- Sea level rise will reduce the area for groundwater recharge by 5-10% by 2045.
- An increase in storm surges will mean that declines in groundwater quality (due to increased salt content) become more frequent.

Dry scenario

- Less rainwater for capture and groundwater recharge. 10% rainfall decrease = 7% decrease in groundwater recharge, and 20% decrease = 10% decrease in recharge.
- An increase in the number of hot days will increase water demand, but not significantly.
- Sea level rise will reduce the area for groundwater recharge by 5-10% by 2045.
- An increase in storm surges will mean that declines in groundwater quality (due to increased salt content) become more frequent.

WORKSHOP ACTIVITY: IMPACT MAPPING

EXPECTED OUTCOME

A map of the likely chains of events (linked by arrows) caused by possible climate impacts (an example is provided in Figure 7).

PREPARATION

Participants choose the scenario (wet or dry) that is most similar to the regional climate projections (presented in session 5).

For a dry scenario: Along the bottom of a large piece of paper write the following climate drivers with a red pen: rainfall decrease, temperature increase, sea level increase, and storm surge increase.

For a rainy scenario: Along the bottom of a large piece of paper write the following drivers with a red pen: rainfall increase, temperature increase, sea level increase, and storm surge increase.

TIMING

40 mins

MATERIALS

- Large pieces flip-chart paper
- Pens or markers

PROCESS

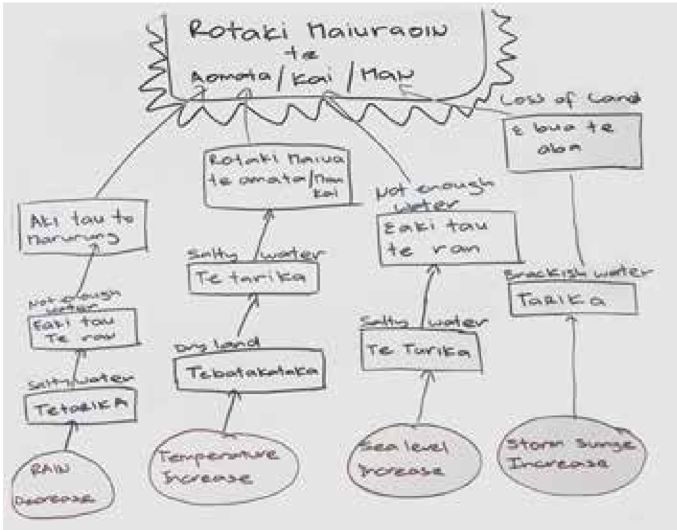
Split participants into small groups of approximately 5 each.

- **For a dry scenario:** The participants start with the 'rain decrease' driver, and write down what will happen if rain decreases. For example, the water in the wells decreases, then above this impact write out what would happen next.
- **For a rainy scenario:** The participants start with the rain increases indicator and write down what will happen if rain increases, then above this impact write out what would happen next.
- Each group then reports back to whole meeting on their impact map.
- Discuss the similarities and differences.

TIPS & TRICKS

Using small groups for this activity will allow for more participation. Ideally at least half of the groups should develop an impact map with the dry scenario, and the rest of the groups develop a map with the wet scenario to illustrate the different potential impacts. Position a facilitator on each table to assist and prompt the participants so that they do not jump too quickly to the final impact (e.g. poor health) but consider the each link in the chain of impacts.

Figure 7: Examples of impact maps developed by workshop participants



SESSION 7

INDICATORS OF CHANGE

An indicator can tell you if something has happened or not. For example, an indicator can provide you with a clue that there has been a change in the water quality that might make it unsafe to drink.

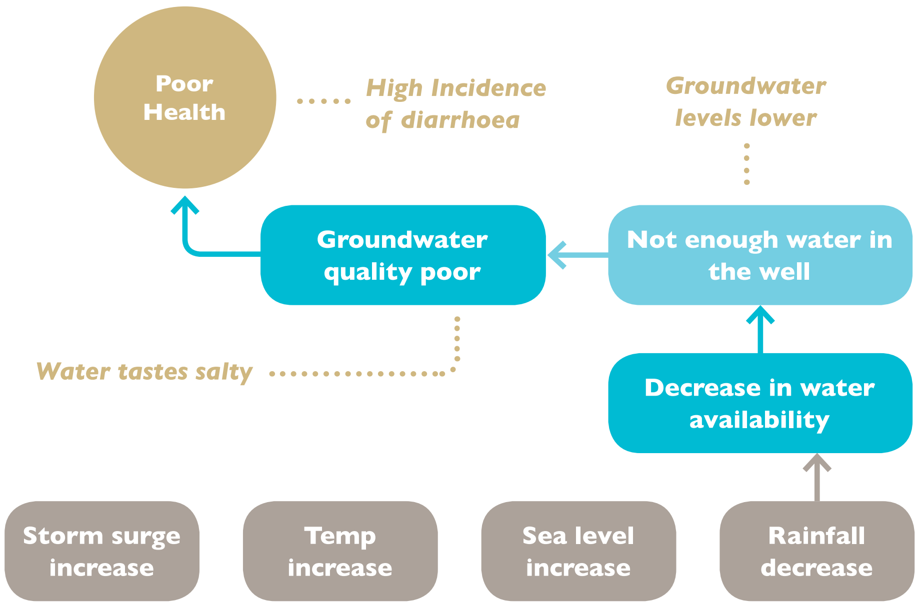
When the indicator reaches a certain level (or threshold), it may trigger a new action to improve the situation. For example, the water in a groundwater well may become too salty to drink due to sea level rise. In this case a new water supply must be identified to provide safe drinking water for a household or a community.

Indicators can be written directly on the impact map from the previous session to show how impacts can be detected (see Figure 8).

Additional details of the indicator can be captured in a simple table (see Table 4), such as who would be in a position to see the change, who could respond, and what the threshold level of the indicator should be.

It is also interesting to ask the participants about what they understand the about the decision making process i.e.
- Who would they tell about changes in the situation?
- How would a new option be approved and funded?

Figure 8: Example of how to identify indicators of change on an impact map



WORKSHOP ACTIVITY: INDICATORS OF CHANGE

EXPECTED OUTCOME

A comprehensive table of the impacts, their associated indicators, the acceptable limits of the impacts, and who would be in a position to observe the indicator. This information will be used in Session 8.

PREPARATION

Prepare a table on the large flip chart paper with 4 columns: Impacts, Indicator, Who will know? and What is the acceptable level? (see Table 4).

PROCESS

- Explain to the participants what the indicators (or clues) are in this context.
- Participants remain in their groups.
- In a different coloured pen, the participants write down an indicator for each of the impacts on the impact map. They should answer the question "How will you know there is [insert impact]?"
- Participants fill in the table by writing all of the impacts and their associated indicators in the first two columns.
- Participants then discuss and complete the table for the "Who would know?" and "What [in your mind] is the acceptable limit beyond which action would be required to fix the situation?
- Discuss the decision making process for their community

TIMING

100 mins

MATERIALS

- The impact map
- Large flipchart paper
- Pens or markers

TIPS & TRICKS

It might be easier for the participants to begin with the impacts at the top of the page i.e. poor health, and then work their way down the impact map.

Table 4: Example of an indicator table

Impact	Indicator	Who will know?	What is the acceptable level?
Poor health	High incidence of diarrhoea	Nurse, health clinic	10 people per week
Poor groundwater quality	Water tastes salty	Community members	No salt in the water
Not enough water	Groundwater levels in the wells is lower	Community members, water technicians	Water level drops by half

SESSION 8

RESPONDING TO INDICATORS

It is unknown how and when climate change will impact drinking water supplies in the future, it is important to start planning for new water supplies now, so that a plan can be implemented quickly to minimise water shortages. The use of indicators provides a signal for when new drinking water sources need to be identified and implemented.

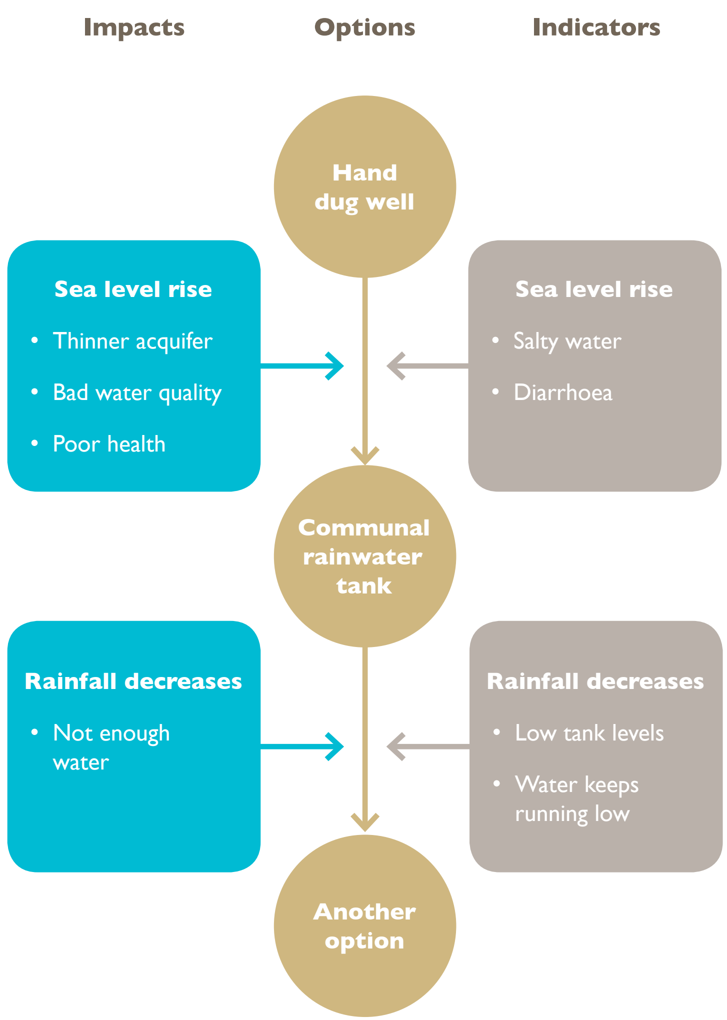
This session is designed to bring all the work done in the previous sessions together. It draws on the prioritised list of response options to address the negative impacts of changes to factors such as climate change or population on the drinking water supply system.

When an indicator exceeds the acceptable level (defined in the table compiled in Session 7), this acts as a trigger for planning for the next-best response option (in this case a drinking water supply option). If at a later date an indicator for the new supply option exceeds the acceptable level, the process is repeated to identify the next best water supply option.

The process is illustrated by the example shown in Figure 9. Starting with the option of a hand dug well at the home, participants consider the likely impacts (shown in the blue squares) due to decrease in rainfall and their associated indicators (the brown squares). The indicators provide a signal for the need to select a new drinking water supply option. They then choose the next option from the prioritised list of options finalised in Session 4 and the process is then repeated.

This process of constantly reviewing the impact of climate change on water supplies, and then deciding if a new option is needed can be called a Dynamic Adaptive Management Process (DAMP). By regularly reviewing how their supply options are functioning under changing conditions, the community will be able to plan adaptive responses to any adverse changes in a timely manner.

Figure 9: Mapping the responses to the impacts and indicators for decrease in rainfall



WORKSHOP ACTIVITY: RESPONDING TO INDICATORS

EXPECTED OUTCOME

A sequence of preferred options in response to climate change impacts, and the associated indicators of the change that will trigger an adaptation response.

PREPARATION

Prepare a sheet of paper as shown in Figures 9 and 10, i.e. with columns for Impacts, Options and Indicators and empty boxes for the participants to use. Allow space to insert the details for four options.

PROCESS

- Participants remain in their small groups.
- Participants write down (in the first box in the middle column) the most common water supply source that is currently used in the village.
- Participants consider the likely climate related impacts on this source, and the associated indicators of change due to the impacts of factors such as a rainfall decrease or increase in storm surges (for example, the dry or wet scenarios used in session 7).
- Participants then identify the next-best water supply option from the prioritised list developed in Session 4 and write this in the next options box.
- Participants then repeat the exercise for this new option – i.e. they identify the impacts and their associated indicators.
- Participants repeat the exercise until they identify at least three new options.
- Allow each group to report back on their activities from Sessions 3 and 4, and to reflect on why their sequence of options allows them to respond to water shortages in the future.
- Discuss any similarities and/or differences among the groups' lists of options.

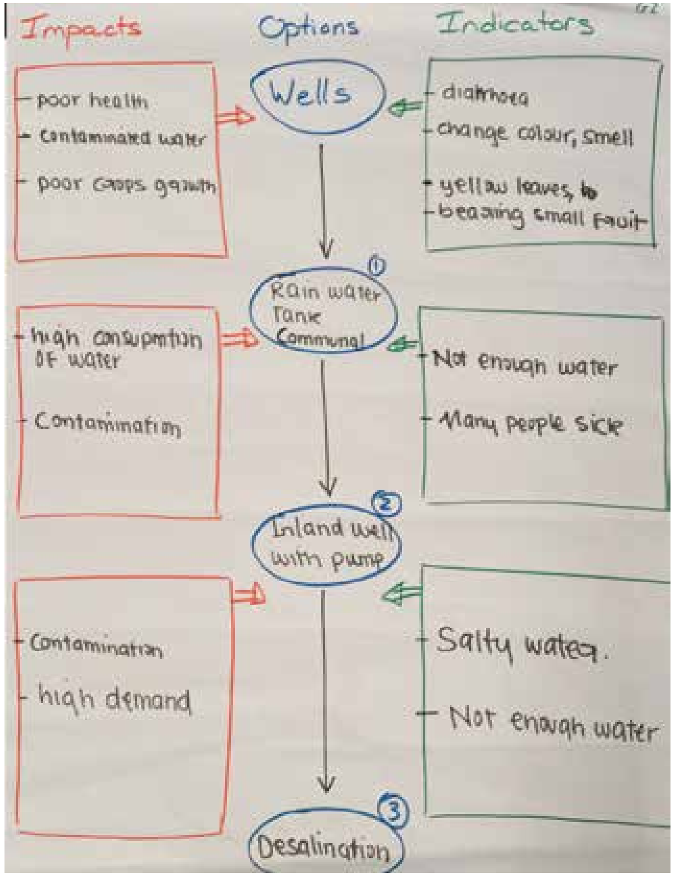
TIMING

90 mins

MATERIALS

- Large flipchart paper
- Pens or markers

Figure 10: Example of the responses to the indicators



APPENDIX 1

Background information for Kiribati

The remote Pacific Island nation of Kiribati is a group of 33 coral atolls that straddle the equator and are dispersed across vast ocean distances. It is one of the least developed Pacific Islands and has few natural resources. Foreign financial aid accounts for 20-25% of GDP, with copra, fish, tourism and remittances from citizens working abroad composing the majority. Economic development is hampered by a shortage of skilled workers, poor infrastructure and isolation from international markets.

Kiribati is one of the most vulnerable nations to the effects of climate change and rising sea levels, with an average elevation of less than two metres above sea level. High tides have already destroyed homes and resources that are critical to livelihoods, such as coral reefs and fisheries.

The water resources of communities across Kiribati are already affected by saltwater intrusion into groundwater as well as by frequent coastal inundation and accelerated coastal erosion caused by sea level rise and the increased frequency of storms and tropical cyclones. This makes the water unsafe for people to drink, increases the risk of epidemics, and reduces yields from agriculture. Such effects place additional strain on people's livelihoods and wellbeing (economic security, health, infrastructure etc.)

On some islands, low rainfall and rising temperatures are also reducing freshwater supplies – directly affecting human wellbeing and the productivity of farming, and sometimes necessitating severe water rationing. These impacts are likely to be compounded through projected climate change by negatively affecting both the quantity and quality of groundwater resources through variations in precipitation and rising sea level.

Outer island domestic water supplies

Many rural communities on the outer islands do not have access to secure and safe sources of water. More than two thirds of the households on the two outer islands that are the focus of this project do not have access to protected sources

of drinking water for example, protected wells or rainwater tanks. Open wells are those without lids and thus left open all the time while closed wells comprise those that have lids or have been closed off. With the introduction of pumping and piping systems, wells are closed once pumps and piping systems have been installed.
None have piped water from centralised systems and rely on open wells, rainwater catchments or village scale solar water pumped systems (NSO 2012).

Thus, there are distinct challenges and deprivations related to water security that limit livelihood choices such as small-scale agricultural practices or small business opportunities. These challenges also widen existing gender inequalities as women and girls may have to invest greater time accessing clean potable water, limiting time spent on livelihood and educational activities. Lastly, water security also drives processes such as migration to urban centres to access reliable infrastructure services

Historical climate trends

In the Gilbert Islands in Kiribati the average recorded temperatures have increased by 1°C from 1950 to 2009, while maximum temperatures have increased by 0.18°C per decade over the past 60 years (PCCSP 011b).

The annual rainfall in the Gilbert Islands can be described as highly variable, due mainly to El Nino and La Nina events. However a gradual increase in rainfall is observed for the traditionally wet seasons (PCCSP, 2011).

These figures show both the overall trend over time as well as the high variablity from year to year.

Figure 11: Average annual temperature change (1950 to 2005)

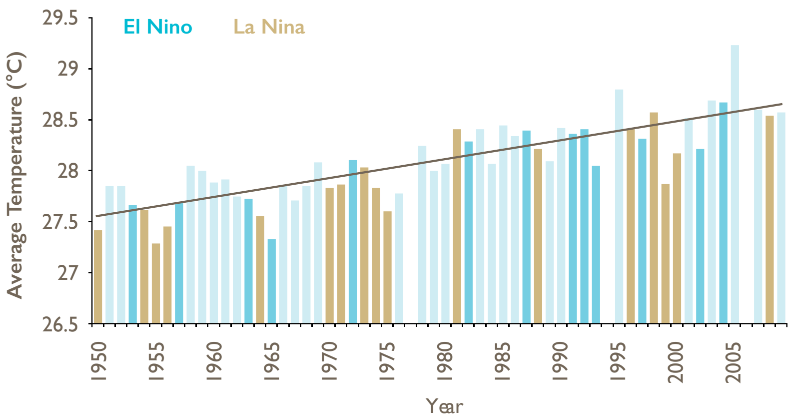
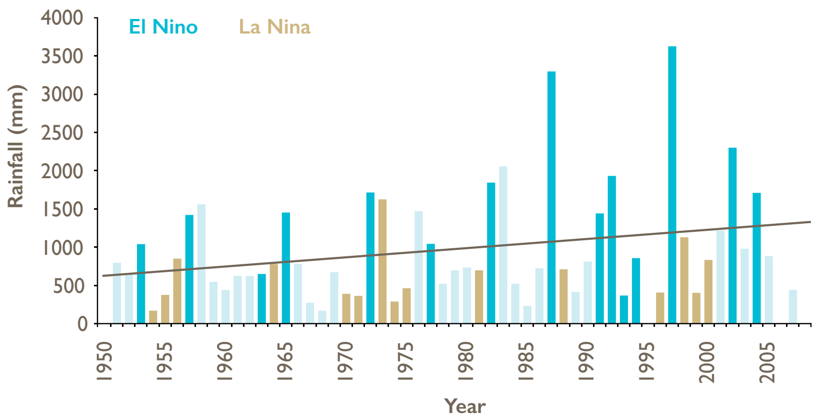


Figure 12: Average rainfall variability (1950 to 2005)



APPENDIX 2

Future climate trends

Future climate change scenarios for Kiribati are based on projections undertaken
by the Pacific Climate Change Science Program (PCCSP), using 18 different models that best represent the climate of the western tropical Pacific region, specifically the Gilbert Islands. This table uses the Inter-governmental Panel on Climate Change (IPCC) medium (A1B) emission scenario.

Figure 13: Climate change scenarios for Kiribati

	1990 (baseline)	2015 (calculated)	2030	2045	2055
Temp (°C)	0	0.4	0.8	1.3	1.6
Rainfall (mm)	0	+8	+12	+19	+23

References

IPCC (2007) Climate Change 2007: Synthesis report , 17 November.

NSO, 2012. Report on the Kiribati 2010 Census of Population and Housing, National Statistics Office, Ministry of Finance and Economic Planning, Kiribati.

Pacific Climate Change Science Program (2011) Current and future climate of Kiribati (PCCSP).

United Nations Department of Economic and Social Affairs UNDESA (2008). Water for Life 2005-2015.

Suggested outline of a two-day workshop

There is a lot of information and a number of new concepts to cover in the workshop. Therefore it is important to give the participants enough time to grasp the concepts and work through the exercises. The following table provides guidance about how to structure the workshop activities and roughly how much time will be needed for each session. However, the pace of your training should match that of the needs of the participants, and their domestic obligations.

Figure 14: Workshop agenda

Day 1 workshop activities	Duration
Welcome and introductions	30 mins
Session 1: Mapping your village	30 mins
Tea break	
Session 2: Water supply options assessment	70 mins
Session 3: Identification and ranking of selection criteria	60 mins
Lunch break	
Session 3: Identification and ranking of selection criteria (cont.)	30 mins
Session 4: Ranking of the options	60 mins
Tea break	
Wrap up discussion: Review of activities	30 mins

Day 2 workshop activities	Duration
Overview of day 2 workshop activities	20 mins
Session 1: Climate trends	30 mins
Session 2: Impact mapping	40 mins
Tea break	
Session 3: Indicators of change	100 mins
Lunch	
Session 4 Responding to impacts and report back	90 mins
Afternoon tea	
Wrap up and evaluation	40 mins

Evaluation

A key objective of this training is to increase the capacity of local community members to manage their water resources under a changing future. In order to gauge whether your training has been effective, you should consider assessing the participants' skills and knowledge before and after the training workshop.

You might consider using the questions shown in the following box.

Evaluation questions

Tick on box for each question.

Q1) Did you gain knowledge on how to select viable water supply option/s using criteria?

No, nothing new	Yes, some things were new	Yes, everything was new

Q2) Did you gain knowledge on impacts of climate change on water supplies and health?

No, nothing new	Yes, some things were new	Yes, everything was new

Q3) Did you gain knowledge on indicators for when thresholds have been reached to suggest a new option is needed?

No, nothing new	Yes, some things were new	Yes, everything was new

FACILITATOR NOTES

Supporting community adaptation to water shortages in Kiribati

The overarching goal of the project **Supporting community adaptation to water shortages in Kiribati** project is to enhance the adaptive capacity of community based water management systems in the outer western islands of Kiribati. To ensure sufficient water for basic health and hygiene under a changing climate.

The project has three primary objectives:

1. To strengthen the community water management facilitation and planning skills of the Kiribati Climate Action Network (KiriCAN) for selecting viable water supply options in response to climatic changes.
2. To identify locally relevant indicators and triggers that will signal the need to introduce coping strategies and/or to introduce additional water supply sources to meet the basic water and health needs under future climate related impacts.
3. To improve the adaptive management of community based water resources in two local communities on the outer islands of Kiribati.

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Louise Boronyak-Vasco is Senior Research Consultant. She has expertise in environmental sustainability and stakeholder engagement. Her research focuses on climate change adaptation and managing natural resources. Louise has strong interpersonal skills has experience in designing, facilitating and evaluating stakeholder and community engagement activities. She has worked on a number of research projects that have focused on climate change mitigation and adaptation.

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