

# CLIMATE CHANGE VULNERABILITY ASSESSMENT

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## GIZO, WESTERN PROVINCE SOLOMON ISLANDS



Empowered lives.  
Resilient nations.

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# ACRONYMS AND ABBREVIATIONS

CCVA	Climate Change Vulnerability Assessment
COP	Climate Change Conference
GEF	Global Environment Facility
IPCC	Intergovernmental Panel on Climate Change
LDCF	Least Developed Country Fund
LPA	Local Planning Area
MECDM	Ministry of Environment, Climate Change, Disaster Management and Meteorology
MHMS	Ministry of Health & Medical Services
MMERE	Ministry of Mines, Energy, and Rural Electrification
NAPA	National Adaptation Programme of Action
NGO	Non-Government Organization
RCP	Representative Concentration Pathways
SIWSAP	Solomon Islands Water Sector Adaptation Project
UNDP	United Nations Development Program
WASH	Water, Sanitation and Hygiene

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# EXECUTIVE SUMMARY

## CONTEXT AND TRENDS

Gizo is a medium-sized township, and the Provincial Capital of the Western Province of the Solomon Islands. It is located on the coastline and surrounded by hills and a number of other small, low populated islands. Gizo has grown rapidly over the last 15 years, with new migrants arriving from throughout the province and neighboring islands, drawn to work opportunities, markets, and services.

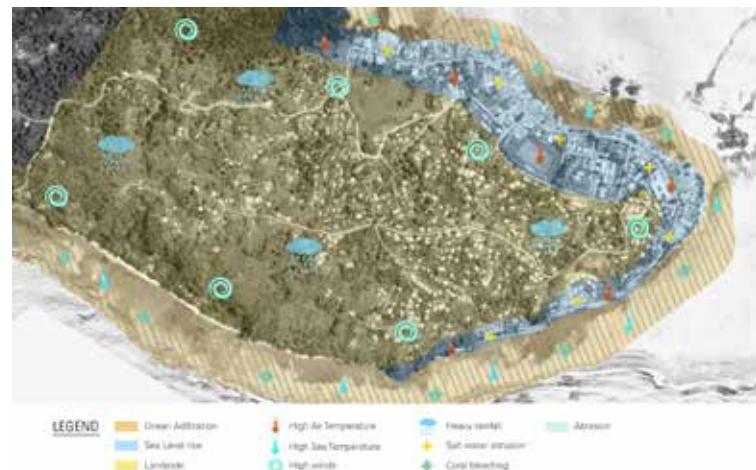
### TRENDS

- OVER THE NEXT 20 YEARS IT IS LIKELY THAT GIZO WILL CONTINUE TO GROW AS NEWCOMERS SEEK HOMES, JOBS AND SERVICES IN THE PROVINCIAL CAPITAL.
- CONTINUED POPULATION GROWTH WILL ALSO INCREASE DEMAND FOR SERVICES, INCLUDING WATER, ELECTRICITY, SCHOOLS, HEALTH CARE AND TRASH MANAGEMENT.
- CONTINUED CONSTRUCTION AND SETTLEMENT OF FORESTED AREAS, IN CLOSE PROXIMITY TO NATURAL SPRINGS, AND ALONGSIDE RIVERS, WILL DEGRADE THE ENVIRONMENT AND ITS CAPACITY TO CAPTURE DRINKING WATER.

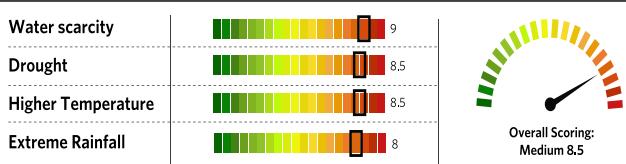
## SUMMARY OF EXPOSURE

Gizo is exposed to a number of natural hazards due to its location on the coastline and also its exposure to heavy rains and landslides. For the local population water scarcity, droughts, and temperature rise are the most serious hazards. Other important climate hazards identified are extreme rainfall, high winds, and the indirect impacts of tropical cyclones.

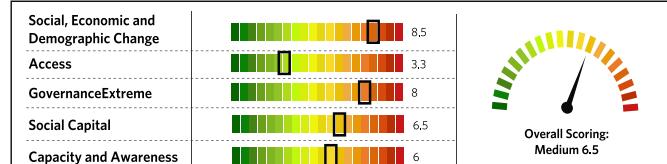
Changing climate conditions have long-term impacts, which can significantly affect the economy, raise costs, and make entire communities more vulnerable.



### Summary of Exposure



### Summary of Sensitivity



## SUMMARY OF SENSITIVITY

Gizo's overall sensitivity is medium. Following evaluation helps to give clear direction as to how different factors can be addressed, to reduce sensitivity.

- **PLANNING FOR GROWTH:** GIZO IS BECOMING MORE SENSITIVE AS IT GROWS IN SIZE BECAUSE NEW SETTLERS THREATEN WATER SOURCES AND CONSERVATION AREAS, AND ALSO DEMAND OUTSTRIPPING SUPPLY. ADEQUATE PLANNING CAN REDUCE SENSITIVITY BY INDICATING WHERE DEVELOPMENT IS SENSIBLE AND DOESN'T NEGATIVELY AFFECT WATER.
- **GOOD GOVERNANCE OF WATER RESOURCES:** LACK OF CLARITY FROM THE PROVINCIAL GOVERNMENT IS CONFUSING AND HAS LED TO A LACK OF ENFORCEMENT. THUS, DEFINING CLEARLY THE ROLES AND RESPONSIBILITIES OF PROVINCIAL, LOCAL AND COMMUNITY INSTITUTIONS WILL HELP INDICATE EXPECTATIONS OF WHO SHOULD BE MANAGING WATER SUPPLY SERVICES.

- **REGULATIONS AND ENFORCEMENT:** LOCAL LAWS AND ORDINANCES ARE NEEDED TO INDICATE HOW WATER SUPPLY IS BEST MANAGED. DEMONSTRATING GOOD ENFORCEMENT AND REGULATORY ENVIRONMENT CAN HELP ATTRACT PRIVATE INVESTORS AND EXPAND THE SYSTEM.

- **PUBLIC AWARENESS AND PUBLIC CAMPAIGNS:** GIZO IS A COMPLEX SOCIETY MADE UP OF A NUMBER OF DIFFERENT ETHNIC GROUPS. CAMPAIGNS TO RAISE PUBLIC AWARENESS ARE NEEDED, TO IMPROVE CONSERVATION MEASURES, IMPROVES COLLABORATION, AND CHANGE BEHAVIOR.

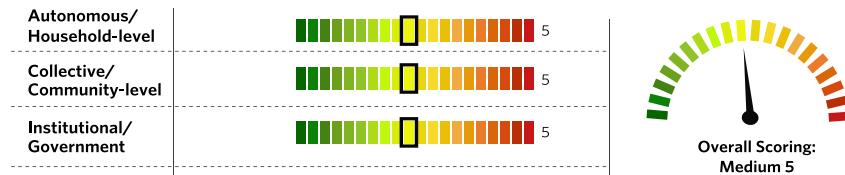
- **GENDER MAINSTREAMING:** IT IS IMPORTANT TO INCLUDE THE INTERESTS OF WOMEN, CHILDREN AND OTHER DISADVANTAGED GROUPS IN ACTIVITIES SUCH AS: DRAFTING LOCAL LAWS, COORDINATING WITH COMMUNITY MEMBERS ABOUT WATER CONSERVATION, SHARING INFORMATION, AND MAKING DECISIONS ABOUT WATER RESOURCE MANAGEMENT.

## SUMMARY OF ADAPTIVE CAPACITY

Overall adaptive capacity for Gizo is medium. Adaptive capacity refers to the capacity, skills and organization that a community possesses to reduce vulnerability to climate change. There are actions at the household, community and institutional levels that can be done to increase adaptive capacity.

Some of these are:

- HOUSEHOLDS ARE PRACTICING WATER CONSERVATION TECHNIQUES, SUCH AS THE SEPARATION AND REUSE OF RAINWATER FOR WASHING OR HOUSEHOLD TASKS. SOME ARE ALSO HARVESTING RAINWATER DURING PERIODS OF HEAVY RAIN.
- AT THE COMMUNITY LEVEL THERE ARE NEW CITIZEN INSTITUTIONS THAT ARE HELPING MANAGE LOCAL SERVICES SUCH AS THE SOLID WASTE COMMITTEE AND THE NEW WATER COMMITTEE INITIATED BY SIWSAP.
- NATIONAL AND PROVINCIAL GOVERNMENT HAVE EMITTED WATER ORDINANCES RELATED TO WATER AND SANITATION (ALTHOUGH MORE ARE NEEDED) AND HAVE MADE THE LINK BETWEEN CLIMATE CHANGE ADAPTATION PLANS AT THE NATIONAL AND LOCAL LEVELS.



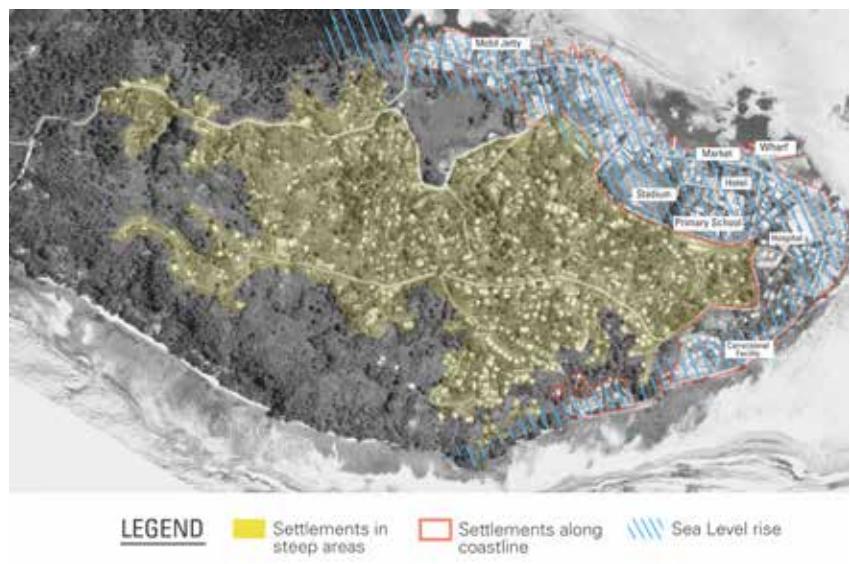
## SUMMARY OF VULNERABILITY

Gizo is vulnerable to climate change not only due to its exposure to a variety of climate hazards, but also due to a number of man-made factors that make it sensitive.

- **MANAGING GROWTH AND CONTROLLING HUMAN SETTLEMENTS:** AS A FAST-GROWING PROVINCIAL CAPITAL GIZO ATTRACTS NEWCOMERS; CURRENT WATER SUPPLY INFRASTRUCTURE IS ALREADY OVERSTRETCHED SO MANAGING GROWTH IS ONE OF GIZO'S BIGGEST CHALLENGES. SQUATTING BY MIGRANT ARRIVING IN GIZO WHO SETTLE IN CONSERVATION AREAS OF THE WATERSHED IS REDUCING WATER ABSORPTION CAPACITY.
- **ILLEGAL CONNECTIONS:** MANY HOUSEHOLDS ARE TAPPING INTO WATER SUPPLY PIPES AND DIMINISH WATER SUPPLY FOR THOSE IN THE TOWNSHIP CENTER, AS WELL AS VANDALIZING GOVERNMENT PROPERTY.
- **INSUFFICIENT WATER FOR RESIDENTS:** THE RESULT OF DIMINISHED WATER CATCHMENT CAPACITY AND ILLEGAL TAPPING IS THAT THERE IS INSUFFICIENT WATER TO THOSE CONNECTED TO GOVERNMENT SUPPLY LINES.
- **BROKEN PARTS:** ANOTHER PROBLEM IS BROKEN PARTS. WITH LITTLE FUNDING AND CAPACITY AVAILABLE BROKEN PARTS HAVE COMPROMISED THE SYSTEM WHICH HASN'T BEEN ADEQUATELY REPAIRED.
- **LOW AWARENESS ABOUT WATER MANAGEMENT:** THERE IS LITTLE AWARENESS ABOUT GOVERNMENT REGULATIONS OR SUSTAINABLE WATER PRACTICES, AND THIS PUTS HOUSEHOLD SUPPLY AT THREAT DURING TIMES OF WATER SCARCITY
- **UNCLEAR GOVERNANCE:** THERE IS A LACK OF CLARITY ABOUT RESPONSIBILITIES, SO CONFUSION REIGNS AND AFFECTS THE CAPACITY FOR AN INSTITUTIONAL RESPONSE.

## POLICY RECOMMENDATIONS

- REGULATIONS ARE NEEDED TO BETTER ADMINISTER WATER SUPPLY
- REPAIRS AND MONITORING OF THE EXISTING SYSTEM
- THE PROVINCIAL AND NATIONAL GOVERNMENTS REQUIRE CLEARLY ESTABLISHED ROLES AND LEADERSHIP
- WOMEN SHOULD BE ACTIVELY INVOLVED IN WATER GOVERNANCE AT THE LOCAL LEVEL
- EFFORTS TO RAISE PUBLIC AWARENESS
- NEW CHANNELS TO DISSEMINATE AND RECEIVE INFORMATION



# 1. INTRODUCTION

The 2015 United Nations Climate Change Conference (COP21) held in Paris in December 2015 signaled a watershed moment in humanity's response to climate change. The outcome of this summit was a global resolution by governments to take urgent and immediate action in response to climate change impacts. Together they announced measures to diminish man's impact in causing global warming, and the implementation of adaptation steps to ensure a more resilient and sustainable future for communities across the world. Climate change finally is being taken seriously.

In some countries that sense of urgency is demanded more than others, because changing climate conditions are already being felt and putting local communities at risk. The Solomon Islands is one of those nations. It is at the frontline of climate change, and also efforts to respond to it. Being a low-lying nation made up of hundreds of islands in the Pacific Ocean the Solomon Islands are exposed to a number of climate hazards that include heavy rainfall, flooding, sea-level rise, droughts, tropical cyclones and strong winds.

In order to ensure a resilient future, one of the key priority actions for the country is to secure access to sustainable water supply, adequate sanitation and hygiene conditions, for all citizens wherever they are located. The importance of improving water resilience through integrated water resource management has been highlighted in a number of Solomon Islands' national policies and regional frameworks they are part of, including the Solomon Island National Climate Change Policy, the National Adaptation Programme of Action (NAPA), National Development Strategy 2015-2030, the Pacific Regional Action Plan on Sustainable Water and Wastewater Management, and the Pacific Island Climate Change Framework 2006 - 2015.

## ***How do we go from national policy to local actions in enhancing water resilience in the Solomon Islands?***

The Government of Solomon Islands has embarked on a four-year initiative called the Solomon Islands Water Sector Adaptation Project (SIWSAP), to improve the resilience of water resources. The initiative is in partnership with United Nations Development Program (UNDP), through financial support from the Least Developed Country Fund (LDCF), which is managed by the Global Environment Facility (GEF). The program responds to the impacts of changing climatic conditions, particularly for vulnerable communities in Solomon Islands.

### **SIWSAP's overall objective:**

*'To improve the resilience of water resources to the impacts of climate change in order to improve health, sanitation and quality of life, and sustain livelihoods in targeted vulnerable areas'.*

The project is a collaborative partnership between several ministries of the Government of the Solomon Islands: the Ministry of Mines, Energy, and Rural Electrification (MMERE), the Ministry of Environment, Climate Change, Disaster Management and Meteorology (MECDM), and the Ministry of Health and Medical Services - Environmental Health Division. Whilst other projects have focused on the water sector have sought to improve coverage and sustainability of water supply in the Solomon Islands, SIWSAP is different in that it integrates climate change considerations in the vulnerability assessment. SIWSAP also builds on the provincial and community-based various climate change adaptation planning and mainstreaming initiatives that are taking place led by MECDM . It does so with an emphasis on medium-

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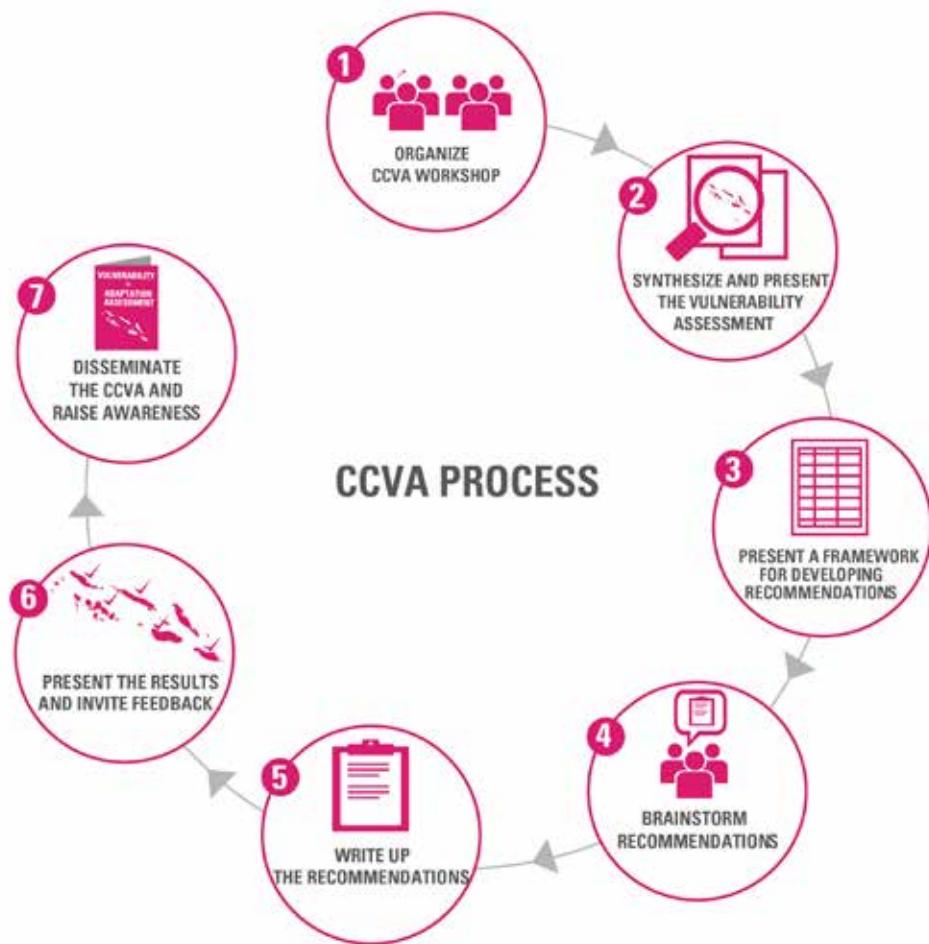
Previous initiatives that SIWSAP CCVA is building on include: Choiseul Province Climate Change Vulnerability and Adaptation Assessment Report (2013); Honiara, Solomon Islands, Climate Change Vulnerability Assessment (2014); SWoCK Vulnerability and Adaptation (V&A) Assessment in Guadalcanal, Isabel, Makira, and Malaita (2012-2013); WASH and Climate Change Development – Strategy, technical brief; Community Drinking Water Safety and Security Planning Pacific Island Countries (2014 / 2015); SIWSAP PPG Pilot Site Reports (2013)

to long-term participatory planning, adaptive water management interventions, improved knowledge management, and governance related to water and sanitation. SIWSAP's ultimate goal is to enhance the livelihoods and empower resilient communities to better respond to climate change.

This Climate Change Vulnerability Assessment (CCVA) is one of the first steps of the participatory water sector adaptation planning process that aims to inform and initiate water resilience actions on the ground.

## 1.1. WHAT IS A CLIMATE CHANGE VULNERABILITY ASSESSMENT?

The Climate Change Vulnerability Assessment (CCVA) is a participatory process between citizens, communities, the provincial and national government of Solomon Islands, and local civil society organizations, to identify weaknesses and assess potential vulnerabilities to climate change, in particular as they relate to water, sanitation and hygiene. The CCVA is designed with two functions in mind: (i) to support a process of raising awareness and building understanding about climate change impacts; and (ii) to support the process of developing a participatory and evidence-based adaptation plan or mainstreaming adaptation into existing development and/or sectoral plans that will inform prioritization of current and future water sector adaptation implementation.



**Figure 1:** Step-by-Step process diagram of the Climate Change Vulnerability Assessment (CCVA)

Understanding about the causes and impacts of climate change is still limited in the Solomon Islands, so raising awareness is important because it allows citizens and governments to decide how to best prepare their communities and adapt to the threat of climate change. Developing a climate change adaptation plan is also essential because it engages people to think about the future of their community, and decide upon the most suitable portfolio of adaptation options are needed so they can achieve their development goals despite potential negative impacts from climate change.

Participation and involvement of many members of the community helps to not only include diverse views and opinions, but it also gives credibility and visibility to the process.

## 1.2. HOW TO USE THIS CCVA REPORT

This CCVA document is designed to communicate knowledge about climate change to two distinct audiences: firstly to residents and civil society members living in communities across the Solomon Islands, including women, children and the elderly; and secondly to government officials, development agencies, and policy decision-makers. It is designed to be read by individual readers, and also used in workshop gatherings for large numbers. There are two main features of the CCVA that are useful for raising awareness: colorful illustrations, which can be used to provoke reflection and facilitate discussion; and narrative text, that can be used by a facilitator to read aloud to participants of workshops, telling stories about climate impacts, and help encourage reflection and discussion.

Efforts to communicate climate change often fail to reach wide audiences because they often present information in complex and scientific terms that citizens and community members struggle to relate to and absorb. This CCVA is designed to generate discussion and reflection, and lead its audience towards thoughtful consideration about how to make their communities more resilient and better adapt to climate change.

The main concept related to assessing vulnerability is that while exposure to climate hazards, such as heavy rainfall, flooding, sea-level rise, strong winds, droughts and tropical cyclones, is difficult to alter, we can change our sensitivity and adaptive capacity to them. The CCVA will further explain those terms and concepts, but it hopes to convince people that reducing vulnerability to climate change is in our hands, and that it is possible to ensure a resilient future for communities all across the Solomon Islands.

The results of the CCVA help to establish a reference and point of departure in the creation of a community-based Water-Sector Climate Change Adaptation Plan (referred to as WS-CCA). This WS-CCA will be a medium- to long-term planning document that can support efforts to plan for, and implement, projects, policies, and actions that increase resilience to climate change impacts, and improve the sustainability of WASH interventions.

## 1.3. CCVA METHODOLOGY FOR GIZO

The CCVA was created through a six-month long participatory methodology that engaged with a diverse set of community stakeholders, and incorporated their voices and comments into successive versions of the report. The survey took place between September 2015 and February 2016, during this time a team of experts and government officials from MMERE, MECDM and SIWSAP visited Gizo on two occasions. During these visits two workshops were held which engaged participants in discussions about climate change impacts, water and sanitation issues, and the governance of water and natural resources. These workshops were both learning sessions as well as opportunities to gather information, and verify analyses. A further survey was also conducted on community perspectives regarding exposure to climate hazards (See Appendix A4).

## 2. INTRODUCTION TO CLIMATE CHANGE

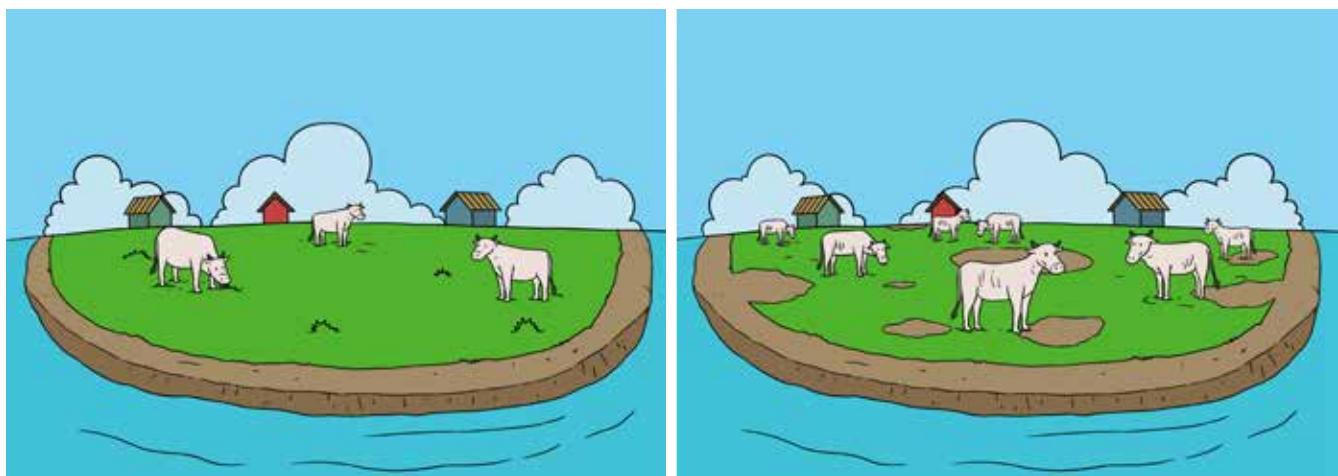
Climate change is being experienced all over the world, its effects are being felt in changes in weather patterns, more extreme weather conditions, and rising sea-levels. Climate change is caused by human activities, such as driving cars, farming, and burning coal; these activities produce greenhouse gases – mainly carbon dioxide, methane and nitrous oxide – which gather in the atmosphere and act to trap the sun's heat.

The more greenhouse gases we emit, the faster the world's climate heats up. This process is often called 'global warming' but it is better to think of it as 'climate change' because it is likely to bring about more extreme events – floods, storms, cyclones, droughts and landslides – rather than an increase in temperature alone. Climate change could have significant impacts on the economy, environment and the way we live.

### GOVERNANCE AND THE MANAGEMENT OF WATER

Management of scarce natural resources, such as water, is at its heart a governance issue. What water reserves are scarce, or there are limited natural resources, coordinated measures have to be taken by all members of that community so that they can share in accessing it. Such measures might include imposing a limit to the amount of water each household can use, or agreeing upon certain times of day that people can use it. These regulations help ensure that that limited amount of water is enough for everyone, today and into the future.

However, if, for example, households or groups in that community, decide to break those rules, taking more water than they are allowed to, the water management system is threatened. This behavior may set an example to other households to also disobey the rules, drawing on water resources as they will; this will result in there being less and less water for others. Soon enough the limited resource will be finished for everyone. This situation is referred to as the 'Tragedy of the Commons'; when communal resources are well managed and shared, there is enough for everyone. But when people act selfishly and there are now regulations governing the sustainable use of their resource, then it will likely be used up, or only available for a few.



**Figure 2: Tragedy of the Commons** - Natural resources that are managed with good governance and understanding between all parties (left picture) will last longer than if people act selfishly and only in their own self-interest (right picture). This requires sacrifice for the greater good of the community and for people to abide by regulations.

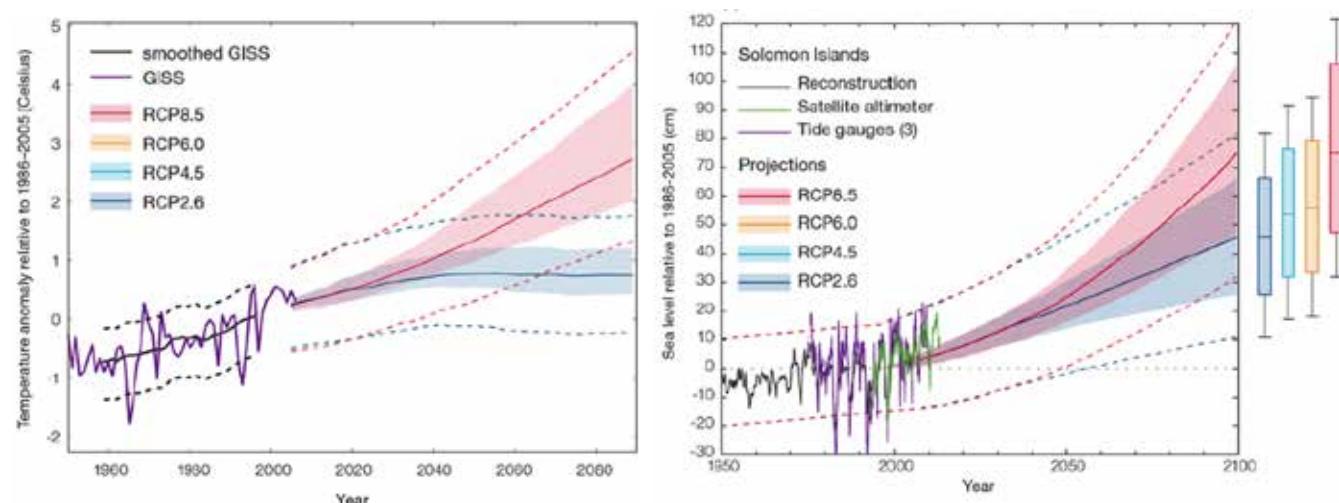
Section A1 (in the Appendix) provides some more information about climate change and what causes it.

## 2.1 WHAT DOES CLIMATE CHANGE MEAN FOR THE SOLOMON ISLANDS?

This section looks at projected climate changes and associated hazards for the Solomon Islands. Section A2 in the Annex describes past changes and variations in the climate of the Solomon Islands.

While all countries are experiencing climate change some are more vulnerable and more at risk than others. The Solomon Islands is one of those countries. As a small island nation with many of its islands lying low and with limited water resources, slight changes in the climate have a disproportionate impact upon the country. Scientific evidence demonstrates that these changes are only due to continue, further impacting the Solomon Islands.

Over the remainder of this century, and possibly beyond, average annual temperatures and incidence of extremely high daily temperatures will continue to rise for the Solomon Islands (*very high confidence*). The amount of increase is dependent upon the future concentration of greenhouse gases in the atmosphere, which in turn is dependent upon future global emissions of these gases. The difference between relatively low and high greenhouse gas concentrations by the end of the century is a temperature increase for the Solomon Islands of between approximately 1 and 3 °C above the 1986-2005 mean temperature.



**Figure 3:** Historic trends and projected future changes of the average annual temperature anomaly (left) and the average sea level (right) for the Solomon Islands region. The pink band represents future changes if global greenhouse gas emissions remain high, while the blue band represents future changes if emissions are substantially reduced.

Annual rainfall is projected to increase only slightly for the Solomon Islands (*low confidence*), though there are likely to be more extreme rain events (*high confidence*), which can cause flooding. Incidence of drought is projected to decrease slightly (*low confidence*), while ocean acidification is expected to continue (*very high confidence*).

The sea level will continue to rise throughout the Solomon Islands region (and around the world) as the temperature of the oceans increases (resulting in “thermal expansion” of ocean water) and land-based glacial ice melts (*very high confidence*). Figure 3 shows the projected rise in sea level for the Solomon Islands region for the remainder of this century. The solid blue (RCP2.6) and red (RCP8.5) lines indicate that sea level is likely to rise by between about 45 and 75 cm by the year 2100, from present day levels, although it is possible (blue and red shading) that the rise could be as low as 25 cm or as high as 105 cm.

A decrease in tropical cyclone genesis (or formation) frequency for the south-west basin is also projected for the remainder of this century (*medium confidence*), while the mean maximum wind speed and rainfall rates of tropical

cyclones are projected to increase. At present, the best guidance is that globally, these increases are likely to be between 2% and 11% for wind speed, and by around 20% for rainfall rates, within 100 km of the cyclone centre (*medium confidence*).

Lastly, the risk of coral bleaching in the seas around the Solomon Islands (and many other Pacific Island locations) will increase in the future (*very high confidence*), and while El Niño and La Niña events will continue to occur in the future (*very high confidence*), there is currently little consensus on whether these events will change in intensity or frequency.

## 2.2 WHAT CLIMATE HAZARDS WILL IMPACT THE SOLOMON ISLANDS AND HOW?

The following hazards are listed in order of greatest to least exposure risk for the Solomon Islands in general, though the order for specific localities may vary depending upon local conditions. Following a description of each hazard are listed some of the socio-economic and ecological consequences of climate change-related impacts that they may cause. These can be severe, affecting people throughout the Solomon Islands at all scales – the national, provincial and local.

### SEA-LEVEL RISE



Many low-lying areas in the Solomon Islands are already prone to the impact of sea level rise, which is already causing salt-water intrusion into shallow fresh water lenses. Higher sea levels in the future will mean more of this impact, as well as increased coastal inundation during very high tides and storm surges.

Sea-level rise may potentially have the following impacts:

- HIGHER COSTS ASSOCIATED WITH FRESHWATER SUPPLY IF GROUNDWATER BECOMES BRACKISH
- MORE DAMAGE TO HOUSES AND OTHER BUILDINGS NEAR THE COAST AS STORM SURGES INUNDATE FURTHER INLAND
- REDUCED LAND AREA AS BEACHFRONT SHIFTS INLAND
- LOSS OF PRODUCTIVE LAND FOR AGRICULTURE DUE TO REGULAR SALTWATER INUNDATION
- HIGHER COSTS ASSOCIATED WITH BUILDING AND MAINTAINING COASTAL PROTECTION STRUCTURES

### HEAVY RAINFALL AND FLOODING



It is expected that a higher frequency of heavy rainfall events, associated with higher temperatures and the ability of a warmer atmosphere to hold more moisture, will result in more flooding events. While a comprehensive assessment of projected future flooding has not been performed for the Solomon Islands as yet, there is a general rule of thumb that the intensity of heavy rainfalls may increase by around 8% for every 1 °C increase in air temperature (based on the Clausius-Clapeyron relationship).

Heavy rainfall and flooding potentially have the following impacts:

- GREATER DISRUPTION TO COMMUNITIES (INCLUDING INJURIES AND LOSS OF LIFE)
- INCREASED COSTS (PROTECTION SCHEMES AND CLEAN-UP) DUE TO MORE FLOODING EVENTS
- HIGHER COSTS (AND POTENTIAL LOSS OF LIFE) ASSOCIATED WITH MORE SEVERE TROPICAL CYCLONE DISASTERS
- INCREASED LIKELIHOOD FOR LAND SLIDES, HIGH SEDIMENT RUN-OFF, AND FLOODING. CATCHMENT AREAS WHERE LOGGING IS PRACTICED ARE PARTICULARLY VULNERABLE
- IMPACTS TO AGRICULTURAL PRODUCTIVITY THAT INCREASE THE VULNERABILITY OF FOOD SECURITY
- DAMAGE TO WATER SUPPLY INFRASTRUCTURE, SUCH AS PIPELINES, AND HAND-DUG WELLS, ESPECIALLY FOR LOW LYING ATOLLS



## TROPICAL CYCLONES

While the number of cyclones may decrease in the future, it is also expected that their wind and rainfall intensity may increase, meaning more damage when they do hit. Tropical cyclones are the most devastating climate hazard for the Solomon Islands, and many other Pacific Island countries; thus it is imperative that communities prepare for the impacts of tropical cyclones. This includes such high priorities as: hardening of infrastructure, establishing procedures for evacuations and mobilization of resources, and getting access to timely forecasts and warnings.

Tropical cyclone damage may potentially have the following impacts:

- DISRUPTION TO COMMUNITIES INCLUDING INJURIES AND LOSS OF LIFE
- INCREASED COSTS, DUE TO PROTECTION SCHEMES AND CLEAN-UP, DUE TO MORE FLOODING EVENTS
- HIGHER COSTS, AND POTENTIAL LOSS OF LIFE, ASSOCIATED WITH MORE SEVERE TROPICAL CYCLONE DISASTERS



## DROUGHT

Droughts (and their related impact on water security, fire risk and agricultural productivity) will continue to be a hazard into the future (e.g. related to El Niño), though any changes to their frequency and intensity is very uncertain. Annual rainfall is projected to increase slightly for the Solomon Islands, however there is a large degree of uncertainty so confidence in the projection is low.

Drought may potentially have the following impacts:

- HIGHER COSTS ASSOCIATED WITH FRESHWATER SUPPLY (E.G. SHIPPING IN WATER) IF STREAMS AND RAIN TANKS DRY UP AND/OR GROUNDWATER IS DEPLETED
- HEALTH IMPACTS INCREASE AS PEOPLE ARE DRINKING WATER FROM TAINTED SUPPLIES
- A REDUCTION IN AGRICULTURAL PRODUCTIVITY DUE TO LOW RAINFALL
- HIGHER COSTS ASSOCIATED WITH IMPORTING BASIC FOOD SUPPLIES

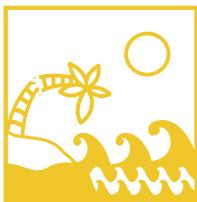


## HIGH WINDS

Little is known of how the frequency and intensity of tropical storms (that are not tropical cyclones) may change in the future. However, it is likely that such storms, which are often associated with high winds, will continue to be a hazard for many parts of the Solomon Islands.

High winds may potentially have the following impacts:

- DISRUPTION TO COMMUNITIES, INCLUDING INJURIES AND LOSS OF LIFE
- DAMAGE TO SETTLEMENTS AND INDIVIDUAL HOUSES
- DAMAGE TO WATER SUPPLY INFRASTRUCTURE
- TREES BLOWN OVER
- INCREASED COSTS DUE TO REPAIRS AND CLEAN-UP
- LOSS OF INCOME FROM AGRICULTURE AND FORESTRY
- INCREASED RISK OF COASTAL EROSION OF LAND
- LOSS OF PRODUCTIVITY AS OUTDOOR ACTIVITIES ARE RESTRICTED DURING PERIODS OF HIGH WIND (PARTICULARLY OCEAN RELATED INDUSTRIES/TRANS PORT)
- HIGH EVAPORATION RATES CAUSE DEPLETION OF WATER RESERVES OF RESERVOIRS AND DAMS
- IN COASTAL AREAS SALT SPRAY CAUSES WATER QUALITY PROBLEMS FOR RAIN WATER TANKS

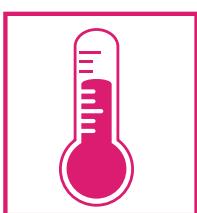


## COASTAL EROSION

Frequent storms and high seas are already causing increased coastal erosion across all of the Solomon Islands. As the sea rises, coastal erosion issues will exacerbate and may lead to the loss of beaches and clogging of mangrove forests.

Coastal erosion may potentially have the following impacts:

- INCREASED SALINE INTRUSION OF COASTAL AREAS. SEAWATER ENCROACHING INTO COASTAL HAND-DUG WELLS MAKES THEM MORE SALINE AND UNSTABLE
- INCREASED SAND TRANSPORT AWAY FROM BEACHES
- LOSS OF NATURAL SAND DUNES
- CLOGGING OF MANGROVE FORESTS DUE TO SEDIMENTATION
- HIGHER COSTS ASSOCIATED WITH BUILDING AND MAINTAINING COASTAL PROTECTION STRUCTURES
- LANDMASS SHRINKING, LEADING TO LOSS OF BEACH, BUFFERING ZONES AND COASTAL LAND

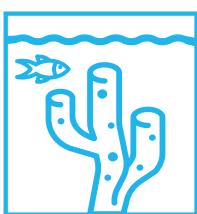


## TEMPERATURE RISE (AIR AND SEA)

As the air and ocean temperatures around the Solomon Islands continue to increase over the remainder of this century, it is likely that there will be an increase in heat-related illnesses, such as heat stroke. Conversely, cold temperature-related illnesses such as respiratory diseases may decrease over time. Note that extremely high temperatures are also a problem for many animals, including livestock.

Higher temperatures for the air and sea may potentially have the following impacts:

- HIGHER MEDICAL COSTS ASSOCIATED WITH MORE HEAT-RELATED ILLNESSES
- POTENTIAL LOSS OF INCOME TO FISHERMEN DUE TO AQUATIC SPECIES LOSS AND/OR MIGRATION (ALSO RELATED TO OCEAN ACIDIFICATION)
- INCREASED EVAPORATION RESULTING IN THE DEPLETION OF WATER RESERVES FROM RESERVOIRS, DAMS, AND GROUNDWATER RESOURCES
- HIGHER RATES OF INTERNAL MIGRATION FROM RURAL AREAS TO TOWNS AS FOOD AND WATER SECURITY BECOMES STRESSED
- IMPACT ON TOURISM AS AIR TEMPERATURES EXCEED COMFORTABLE LEVELS
- REDUCTION IN AGRICULTURAL PRODUCTIVITY DUE TO GREATER INCIDENCE OF PLANT DISEASES/FUNGAL INFECTIONS IN A WARMER AND MORE HUMID CLIMATE
- HIGHER COSTS DUE TO HIGHER ENERGY DEMAND FOR AIR CONDITIONING AND POSSIBLY DESALINATION
- LOSS OF PRODUCTIVITY AS PEOPLE ARE NOT ABLE TO WORK OUTDOORS DUE TO HEAT



## CORAL BLEACHING

Acidification and bleaching events will become more frequent in the future and these phenomena will continue to damage corals and affect the number and variety of marine species in the waters around the Solomon Islands. It is possible that some fish species may migrate out of the Solomon Islands' waters, if ocean temperatures become too high.

Coral bleaching may potentially have the following impacts:

- POTENTIAL LOSS OF INCOME TO FISHERMEN DUE TO AQUATIC SPECIES LOSS AND/OR MIGRATION
- IMPACT ON TOURISM AS CORAL REEFS BECOME BLEACHED
- ECOLOGICAL IMPACT OF LOSS OF SPECIES DIVERSITY
- INCREASED VULNERABILITY TO COASTAL EROSION AS CORAL REEFS PROVIDE AN EFFECTIVE EROSION BARRIER TO WAVES AND TIDAL ACTIVITY
- LOSS OF A CRITICAL FOOD SOURCE FOR MANY COASTAL COMMUNITIES

### 3. SOLOMON ISLANDS CLIMATE PROFILE

While Chapter 2 discussed the general patterns of climate change and related hazards expected for the Solomon Islands, this chapter gives an assessment of likely climate change trends, impacts and possible consequences. The chapter is divided into three scales: national, provincial and local (where the local scale is only for the SIWSAP pilot site locations).

#### 3.1 NATIONAL-SCALE ASSESSMENT

The following general climatic trends are predicted for the Solomon Islands for the remainder of this century, and possibly beyond:



**Figure 4:** A variety of climate hazards will affect communities throughout the Solomon Islands, these include: sea-level rise, heavy rainfall, flooding, temperature rise, tropical cyclones, strong winds, and droughts.

In addition to these general trends, some more specific information and maps are presented in Appendix A3. The hazards associated with these climate changes, and their potential consequences for the people of the Solomon Islands are listed, at different scales, in Chapter 2.

Climate variable	Trend over the remainder of this century
Mean air temperature and very hot days	▲
Annual rainfall and drought	▬
Intensity of heavy rainfall	▲
Sea level	▲
Tropical cyclone genesis (formation)	▼
Tropical cyclone intensity	▲
Ocean acidification	▲
Coral bleaching	▲

**Table 1: National Level Trends for the Solomon Islands**

**Notes:** ▲ = Increase; ▼ = Decrease; ▬ = No trend identified

## 3.2 PROVINCIAL-SCALE ASSESSMENT

While downscaled climate change projections are not available at the provincial scale for the Solomon Islands, we can see some geographic variation in the projected climate changes from global climate models. The maps shown in Appendix A3 show future changes in air temperature, rainfall, humidity and cloudiness that are based on the same global climate models that were used in the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5). Based on these maps, we can conclude that there are likely to be the following slight variations across the Solomon Islands region.

### TEMPERATURE

There is very little difference in the projected temperature changes over the Solomon Islands region with the exception of Figure A3.2 (RCP2.6) where there is a very weak gradient of greater temperature change in the north compared with the south.

### RAINFALL

Choiseul and Western Province are projected to have a slightly larger increase for RCP8.5 (10 – 20%), compared with the other provinces (0 – 10%) (See Figure A3.3 in Appendix A3). This spatial pattern also shows up in Figure A3.5 (soil moisture), with a gradual gradient from higher to lower percentage increases from the northwest to the southeast of the country. Based on these projections, the north-western regions may be slightly less exposed to drought in the future than the south-eastern regions.

### HUMIDITY AND CLOUDINESS

For specific humidity (Figure A3.6) and downward solar radiation at the surface (Figure A3.7) there is some indication in the RCP8.5 maps of larger changes (increase for specific humidity and decrease for solar radiation) in Choiseul and Western Provinces, compared to the other provinces.

### OTHER VARIABLES

For all other variables (i.e. heavy rainfall intensity, sea level rise, tropical cyclone risk, ocean acidification, and coral bleaching), there is no additional regional information available so the national assessment above should apply.

### 3.3 LOCAL-SCALE ASSESSMENT

The six pilot sites for the SIWSAP project are shown in the map below. All of these sites (and indeed, all locations in the Solomon Islands) will be exposed to the climate change trends and hazards described above. The local impacts of climate change however, will vary depending upon (among other things) the physical characteristics of the sites. Below, we outline the most significant climate change hazards for Gizo.



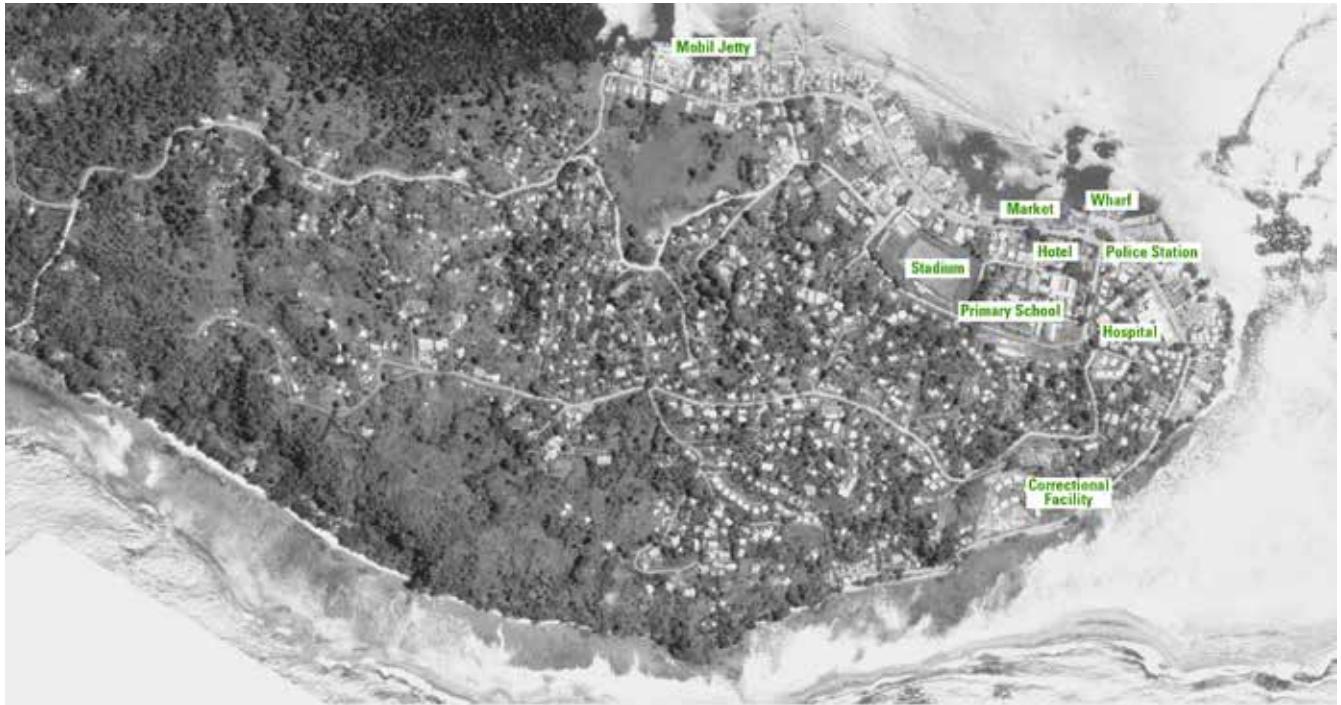
Figure 5: Location of Gizo Township in Western Province and six pilot sites for the SIWSAP project (see Inset).

#### GIZO TOWNSHIP

Gizo is located on the coast and is greatly exposed to the impacts of sea level rise and storm surge. Coastal inundation, erosion and saltwater intrusion into shallow aquifers are therefore the major hazards for these locations. Drought is also a major hazard, as when rainfall is low for long periods the amount and quality of fresh drinking water as well as agricultural production is severely reduced. Steep hills around the town also means that erosion and landslides are a hazard (exacerbated by deforestation), related to heavy rainfall events.

These maps are derived from data averaged from several global climate models. Any one of these models may show different (and plausible) spatial patterns than what are presented. The maps are based on data that are not downscaled to local conditions, but rather are from coarser resolution global model output. Nevertheless, at this time it is considered that the patterns shown in these maps are the best available guidance regarding the general spatial variability of climate changes over the Solomon Islands region.

## 4. GIZO'S CONTEXT



**Figure 6:** Gizo is located in Western Province along the coastline. As more people have moved there human settlements have spread outwards from the port.

### 4.1 GEOGRAPHIC

Gizo is a medium-sized township, and the Provincial Capital of the Western Province of the Solomon Islands. It is located on the coastline and surrounded by hills and a number of other small, low populated islands, one of which hosts Gizo's airport. Between the hillside communities and neighboring islands there are many people who come back and forth to Gizo by boat and trucks to access the market, public services and employment opportunities. In the city center there are paved roads, churches, schools and a commercial area, but outside of this small urban core settlements rise haphazardly on hillsides.

Gizo Island - 34.95 km<sup>2</sup>.

### 4.2 DEMOGRAPHIC

Gizo is one of the largest townships in the Solomon Islands, it has grown rapidly over the last 15 years, with new migrants arriving from throughout the province and neighboring islands, drawn to work opportunities, markets, and services. The 2009 census states that Gizo's population is 7,177 inhabitants; that number is far higher during the day because many come to the township for work and trade. Of this population 53% are male and 47% are female (Source: SIWSAP Project Document, 2014). With its rapid growth many of Gizo's hillsides have been settled without approval, as there were few other options for available land. This causes problems for water catchment that serves the township's water supply. Given Gizo's rapid urbanization trend we estimate a 4% annual growth rate (as opposed to the 2.3% rate of other settlements throughout the Solomon Islands), the population would thus be projected to rise to about 20,000 by 2035.

## **4.3 SOCIAL**

The rapid growth of Gizo's population has caused some concern with previous residents, giving rise to some tension over recent years regarding land ownership and access to water supply. Some newcomers have settled in lands illegally, and some have also tapped into water supply networks; these are sources of unease with the authorities too due to the potential impact upon water supply and the issues it may provoke related to land ownership and the implementation of future infrastructure projects. Thus in social terms the rapid growth of the city has come with a degree of social unease.

While traditional attitudes towards the division of labor keep women at home to perform unpaid household tasks and care-giving, there are also many women working outside the home. Men are mostly responsible for contributing to household income and engage in work outside the home.

## **4.4 ECONOMIC/ LIVELIHOODS**

Gizo's economy is diversified, with many public sector jobs, due to its position as the provincial capital, commerce, and the newly emerging tourism sector. The tourism economy is now drawing visitors from abroad, who use hotels, restaurants and dive shops. It is also an important market place for the surrounding islands and communities, so people come there to trade at the public market and numerous shops on the main street.

Although many women in Gizo are housewives working in the informal sector and have fewer livelihood opportunities compared to men, some women have as teaching, micro-enterprise, nursing, and government jobs. Men tend to find more opportunities in the market, and those with higher educational level work as scientists, entrepreneurs, educational officers, government officers, police officers and information technology professionals.

## **4.5 PUBLIC SERVICES**

There are a number of public services that are accessible for people throughout the province, such as the newly inaugurated Provincial Hospital.

<b>Education</b>	There are a number of local primary and secondary schools in Gizo
<b>Electricity</b>	Electricity is accessible in the central areas of township, as is water, but the water supply service, which requires paying a fee, is not in good condition
<b>Water</b>	It is reported that the illegal access to pipes from settlements outside the center has caused the system to stop functioning. Those settlements outside the city center are not serviced by electricity or water
<b>Waste collection</b>	There is regular trash collection in Gizo but there is no official dump site so a lot of trash is dumped on the side of the road.

## **4.6 WATER AND SANITATION AND HYGIENE**

### **WATER**

Gizo Township has a failing Government supplied water supply network. Increasing population combined with a lack of management investment, limited resources, and absent governance has led to water shortages, growing pollution, vandalism and widespread misuse of assets, and increasing health and hygiene issues. Gizo Township faces immediate and significant WASH service provision challenges.

The Gizo water supply was developed in the 1970s. The Gizo reticulated water system is in a failed state and the existing catchment and system design is highly vulnerable to the impacts of Climate Change. The main challenges include: (1)

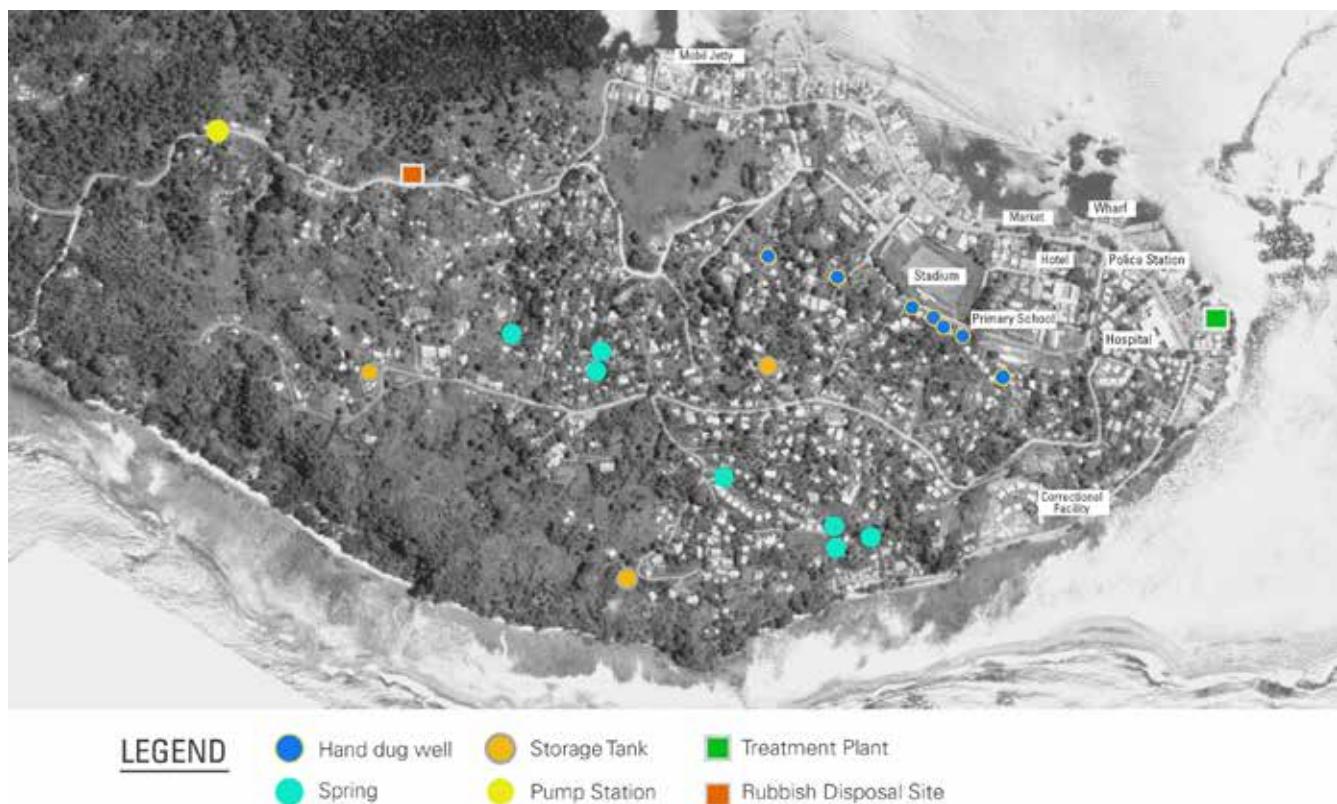
insufficient and unreliable water sources; (2) Poor raw water quality; (3) Insufficient treatment storage capacity; (4) High system losses; (5) Insufficient operational and maintenance activities and/or resources; (6) No water charges or revenue generation and (7) Insufficient funding .

The main water source is from the Leoko Stream Catchment. The water from this source is considered inadequate to meet existing and future demands. The source is gravity fed over 6km along the south-eastern coast of Gizo and passes through the villages of Paelonge, Titiana and New Mala before it reaches a water treatment plant. Significant losses are incurred due to non-regulated (non-permitted) connections - particularly in the village of Titiana. In addition, the system requires regular rainfall due to a small steep catchment and low storage network capacity. The Gizo Township water supply system is managed by the Provincial Government and operated by the works division. The system is in a complete state of disrepair with much of the infrastructure non-functional. An assessment in 2013 estimated that the cost to rehabilitate the system would be in the order of USD2-3 million dollars. Without revenue collection and a cost recovery system there is insufficient local funding for operation and maintenance, resulting in an inability for upkeep of the system and provision of quality services.

In absence of services and regulation people in Gizo Township are largely self-reliant for water supply. Household investment in water tanks within Gizo Township has increased in recent times in response to an increasingly unreliable piped water system, combined with recurring prolonged drought episodes.

Self-supply places particular stress on vulnerable and marginalised members of society- such as the estimated 25% of people living in informal settlements within Gizo Township.

There are a small number of communal rainwater harvesting systems located at the hospital and Provincial Government headquarters. As part of quick fix solutions, SIWSAP is providing additional tankage for the RWASH office, netball stadium, women resource centre and Malakerava near the spring source.



**Figure 7: WASH Map of Gizo Township**

These maps are derived from data averaged from several global climate models. Any one of these models may show different (and plausible) spatial patterns than what are presented. The maps are based on data that are not downscaled to local conditions, but rather are from coarser resolution global model output. Nevertheless, at this time it is considered that the patterns shown in these maps are the best available guidance regarding the general spatial variability of climate changes over the Solomon Islands region.

There are 3 main local springs sources located in central Gizo Township (near the coastline) used for primary water sources. These sources are connected to the reticulation network and used to supplement the town water supply. Historical water quality data suggests these sources have biological contamination. A number of standpipes from these spring sources provide water by gravity flow. The pipework and standpipes are poorly maintained with noticeable leaks. An additional 5 spring sources were identified and logged during a recent 2015 field survey to Gizo Township. All 8 spring sources were found to be slightly brackish (TDS 895-930 mg/L). A small number (6) of local privately owned hand dug wells were identified, mapped and characterised by the SIWSAP team in 2015. Most of these wells were lined and used for secondary (non-drinking) purposes, with many residents relying on them during recent El Nino drought periods. Groundwater along the coastal strips is vulnerable to sea level rise, storm surge, flooding and saline intrusion

## SANITATION

The primary school, police, hospital, Gizo hotel and some churches and housing are connected to a small reticulated sewage system. There is no treatment, with effluent discharged by oversized macerator pumps through an outfall located 200m off the coast at a depth of 15m.

The remaining properties in Gizo Township rely on septic systems or pit latrines for waste disposal. Widespread uptake of water based toilets will place a significant (~30%) additional water usage demand for Gizo Township.

In addition, poor construction and/or management practices will result in surface and groundwater pollution - that is largely irreversible for Towns the size of Gizo.

With an increasing population living in informal settlements there is likely increasing numbers of people without access to improved sanitation, leading to increased rates of Open Defecation and pollution.

## HYGIENE

Residents seem to have an understanding of important hygiene information such as the need to boil groundwater, washing hands and rubbish disposal. Previous projects have sensitized the community on the need for rubbish collection, sorting, reuse and disposal – however no action plan has been implemented.

Future hygiene and WASH education campaigns should prioritise people living high-risk and vulnerable informal settlements. It is noted that cultural sensitivity is needed in future campaigns – inclusive of local languages spoken (for example the Gilbertese community).

The central market and wharf area is a central place for commerce and sees a large number of day visitors. There are no adequate public sanitation, bathing and drinking water facilities provided. The market has daily rubbish collection, though in general the area is dirty and unhygienic and presents a community health risk.

The Provincial Government has a waste collection system in town. Waste is transported to a central rubbish dump that is poorly designed and managed. There is no waste sorting, compacting, run-off management or considered planning other than to dump and burn. The rubbish dump is sprawling in size and presents an unsightly health hazard, particularly for those people living close by in informal settlements. There is no rubbish collection in informal settlement areas.

## MANAGEMENT

There are no local WASH guidelines or regulations administered by the Provincial Government.

Long-term, a paradigm shift is required by Provincial Government in terms of ownership/roles/responsibilities, planning, policy adoption, enforcement of regulations, management of assets and cost recovery for service provision.

## 4.7 TRENDS

A 'trend' indicates the general direction that different issues are moving towards. By imagining if trends continue helps to indicate what key issues will influence the future development of Gizo.

### DEMOGRAPHIC

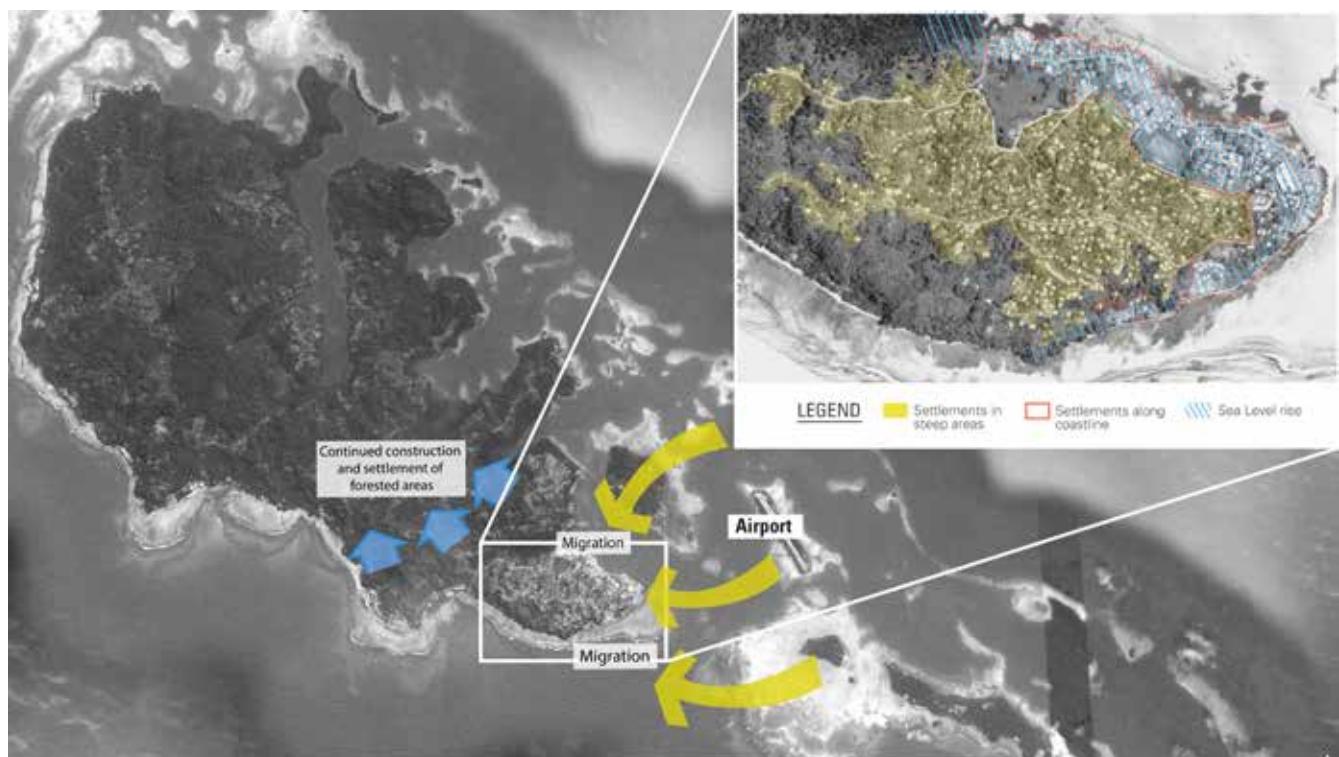
Over the next 20 years it is likely that Gizo will continue to grow as newcomers seek homes, jobs and services in the provincial capital.

### DEMAND FOR PUBLIC SERVICES

Continued population growth will also increase demand for services, including water, electricity, schools, health care and trash management. The hillside settlements and island communities surrounding the township's urban core will require increasing amounts of water and the consolidation of infrastructure and services to better connect them to the rest of Gizo.

### ENVIRONMENTAL RESOURCES/ ECOSYSTEM SERVICES

Continued construction and settlement of forested areas, in close proximity to natural springs, and alongside rivers, will degrade the environment and its capacity to capture drinking water.



**Figure 8:** Urban trends of Gizo: As new inhabitants arrive Gizo is expanding in areas of conservation and along the coastline. Increasing demand for services will continue to put pressure on the limited water supply infrastructure and other public services such as education and health care.

## 5. EXPOSURE

### 5.1. WHAT IS EXPOSURE?

#### **Exposure refers to**

**The degree of climate stress upon a particular unit of analysis (i.e. village, sector), may be characterized by long-term change in climate conditions, or changes in climatic variability including the magnitude and frequency of extreme events in the urban context (IPCC 2007).**

Our vulnerability to climate change is related to our exposure to climate hazards – which include droughts, heavy rainfall and sea-level rise. Exposure varies from one community to another based upon the location and characteristics of that community. For example, villages or townships located close to the sea are more exposed to sea-level rise and coastal erosion, while communities with hills may more worried about landslides brought about by heavy rainfall.

**Changing climate conditions have long-term impacts, which can significantly affect the economy, raise costs, and make entire communities more vulnerable.**



**Figure 9:** Exposure to climate change makes communities more vulnerable; above (right) island communities are exposed to tropical cyclones and high winds, while (right) earth's temperatures are rising, causing more incidences of heat-related illnesses.

## 5.2. METHODOLOGY FOR IDENTIFYING AND PRIORITIZING EXPOSURE

During the months of December 2015 and January 2016 a team of multi-disciplinary experts led by MMERE-WRD EHD and MECDM consulted residents of each of the six pilot communities about what climate hazards were the most likely to affect them in the next two to five years, to establish which ones were most worrying to them. The team also consulted residents about what degree of impact each of the climate hazards would have. These two indicators serve to identify the level or risk that the community faces for each hazard. It also helps us to prioritize which climate hazards are considered most serious to residents, and that require consideration in adaptation strategies.

### The two variables are defined as:

**Likelihood:** Survey participants were asked how likely they felt that they would be affected by the climate hazard (from very unlikely to almost certain).

**Impact:** Survey participants were asked how much of an impact they thought that the climate hazard would have on them (from insignificant to disastrous).

DESCRIPTOR	DESCRIPTION
<b>Likelihood (L)</b>	
1 Very Unlikely	Has not happened in the past and it is highly improbable it will happen in the next 24 months (or another reasonable period).
2 Unlikely	Has not happened in the past but may occur in exceptional circumstances in the next 24 months (or another reasonable period).
3 Possible	May have happened in the past and/or may occur under regular circumstances in the next 24 months (or another reasonable period).
4 Likely	Has been observed in the past and/or is likely to occur in the next 24 months (or another reasonable period).
5 Almost Certain	Has often been observed in the past and/or will almost certainly occur in most circumstances in the next 24 months.
<b>Impact (I)</b>	
1 Insignificant	Hazardous event or climate-related impacts resulting in negligible effects compared to normal.
2 Minor	Hazardous event or climate-related effects potentially resulting in minor impacts (brief disruption to local economic activity, reduced effectiveness of water supply, minor physical damage).
3 Moderate	Hazardous event or climate-related effects resulting in moderate impacts to the community (physical damages to property, interruption of water supply, moderate environmental harm)
4 Major	Hazardous event or climate-related impacts resulting in serious effects to the community (major damages to homes and infrastructure, damage to water supply infrastructure, significant harm to environment and local ecosystems).
5 Catastrophic	Hazardous event or climate-related effects resulting in catastrophic and severe impacts to the community (widespread destruction of homes and infrastructure, breakdown and damages to water supply, irreversible damage to local ecosystems and environment).

**Table 2: Tool 1 - Risk definitions for semi-quantitative risk assessment**

*Adapted from: Sanitation Safety Planning: Manual for Safe Use of Water and Disposal of Wastewater (2015), World Health Organization*

		IMPACT (I)				
		Insignificant	Minor	Moderate	Major	Catastrophic
LIKELIHOOD (L)	1	2	3	4	5	
	Very unlikely	1	2	3	4	5
	Unlikely	2	4	6	8	10
	Possible	3	6	9	12	15
	Likely	4	8	12	16	20
	Almost Certain	5	10	15	20	25
<b>Risk Score (R) = (L) x (I)</b>		<5	6-10		10-15	>16
<b>Risk Level</b>		Low Risk	Medium Risk		High Risk	Very High Risk

**Table 3: Tool 2 - Semi-quantitative risk assessment matrix**

Adapted from: Sanitation Safety Planning: Manual for Safe Use of Water and Disposal of Wastewater (2015), World Health Organization

RISK DESCRIPTOR	NOTES
High priority	It is possible the climate hazard will cause severe physical, economic, social, and environmental harm. It is an urgent priority to take actions to minimize risk.
Medium priority	It is possible the climate hazard will cause moderate to serious harm to physical, economic, social, and environmental harm. Once high priority risks are controlled, actions need to be taken to minimize risk.
Low priority	Climate hazard will have a moderate impact upon the community. The risk should be monitored and revisited in the future.
Unknown priority	Further information is needed to evaluate the risk. Some action should be taken but it is not seen as posing a significant threat.

**Table 4: Tool 1 - Risk category descriptions for the team-based descriptive risk assessment**

Adapted from: Sanitation Safety Planning: Manual for Safe Use of Water and Disposal of Wastewater (2015), World Health Organization

Risk (LxI)			
	>16	<b>Water scarcity</b>	<b>18.51</b>
		<b>Drought</b>	<b>17.96</b>
		<b>Temperature rise (air)</b>	<b>17.45</b>
4	<b>6 to 10</b>	Extreme Rainfall	9.31
5		Tropical cyclones	8.99
6		High winds	8.91
7		Temp rise (water)	7.98
8		Terrestrial erosion	7.94
9		Sea-level Rise	6.47
10		Coastal Erosion	6.00
11		Salt Water Intrusion	5.06
<b>Average</b>			<b>9.92</b>

We tabulated the results and then multiplied the indicator of Likelihood with the indicator of Impact (L x I) to derive an index for Risk. The climate hazards were then ranked in descending order of magnitude; an average was calculated and this helped to determine which climate hazards would feature in this CCVA report (all those above the average).

**Table 5: Gizo's Exposure Score**

## 5.3. CLIMATE HAZARD RISK IN GIZO

To better understand how each of the hazards identified by the community makes Gizo vulnerable, we describe what each climate hazard is, how climate change affects it, and explain what impacts it is having on people and natural systems.



### WATER SCARCITY



Water scarcity means that water is difficult to access during normal periods and during non dry-seasons; resulting in water shortages. Climate change can bring with it water scarcity – due to droughts and salt-water intrusion, both reducing the amount of water supply available to local communities. Water is essential to all life so without water everyone is affected, including livestock and crops. Water scarcity is particularly problematic for island communities where they cannot easily access water from other communities or infrastructure. Water scarcity affects public health and safety and local economies.



### DROUGHT



Droughts are extended periods of water shortage during the dry season and during extreme weather events. Climate change means that periods between rain may get longer, even though the amount of rain is set to slightly increase. The impact of droughts is that there is little water available to communities – this affects the health of people, especially elderly and children, and threatens public health safety if there is not water for hygienic conditions. Droughts negatively impact farmers, and their livelihoods, who depend upon the rain for their crops. Combined with salt-water intrusion droughts mean less consumption of water which is unhealthy.



### TEMPERATURE RISE



High air temperatures mean that people feel the intense heat from the sun, causing people tired, thirsty and even suffer heat stroke. Climate change is causing air temperatures globally to rise. One result of heat-related illnesses are heat strokes, which are particularly dangerous for elderly people, women, and young children. High temperatures also cause problems for livestock and other animals, they can cease producing milk by suffering trauma and death. Such impacts can impact the livelihood of local communities.



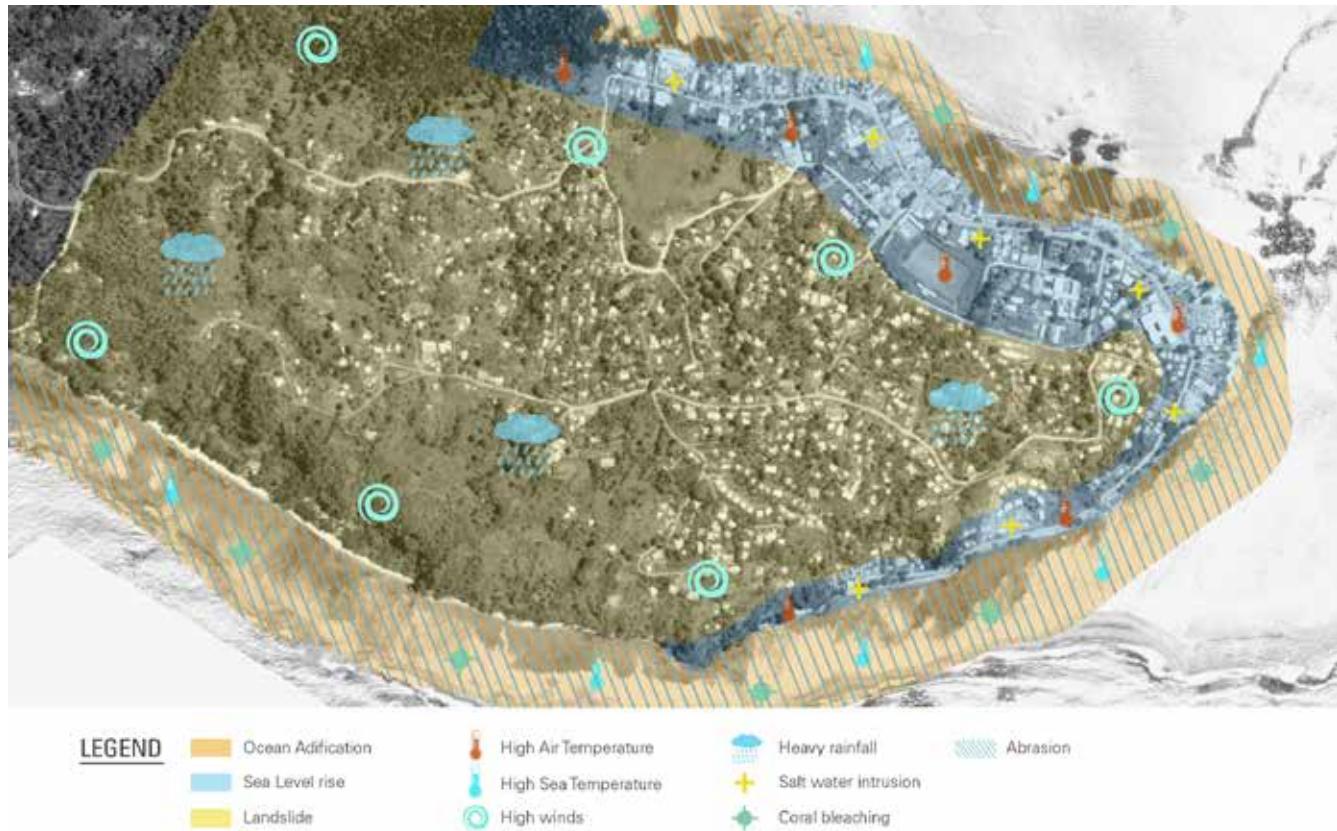
## EXTREME RAINFALL



Extreme rainfall is when there is more rain than average, often it falls more intensely and for longer periods than expected. Climate change is heating the atmosphere which means clouds are able to hold more moisture and thus more rain. More extreme rainfall causes damage plants and the environment, and causes flooding and landslides (terrestrial erosion). Flooding often reduces circulation of people and vehicles, and can also damage infrastructure; this makes it difficult for people to move places and goods, and may impact services and livelihoods. Extreme rainfall can affect the livelihoods of farmers, fishermen, people who have to access markets, it can even close schools and limit other services.

Principal Climate Hazards	Possible Short-term Impacts	Possible Long-term Impacts
<b>Water scarcity</b>	<ul style="list-style-type: none"> <li>Reduction in drinking water as streams and rain tanks dry up and/or groundwater is depleted</li> <li>Reduction in agricultural productivity</li> </ul>	<ul style="list-style-type: none"> <li>High costs associated with importing water and food supplies</li> <li>Health impacts increase as people and animals are drinking water from tainted supplies</li> </ul>
<b>Drought</b>	<ul style="list-style-type: none"> <li>Reduction in drinking water as streams and rain tanks dry up and/or groundwater is depleted</li> <li>Reduction in agricultural productivity</li> </ul>	<ul style="list-style-type: none"> <li>High costs associated with importing water and food supplies</li> <li>Health impacts increase as people and animals are drinking water from tainted supplies</li> </ul>
<b>Temperature rise (air)</b>	<ul style="list-style-type: none"> <li>Reduction in agricultural productivity due to greater incidence of plant diseases/fungal infections</li> <li>More heat-related illnesses</li> </ul>	<ul style="list-style-type: none"> <li>Higher medical costs</li> <li>High costs associated with importing food supplies</li> </ul>
<b>Extreme rainfall</b>	<ul style="list-style-type: none"> <li>Disruption to communities (including injuries and loss of life)</li> <li>Damage to settlements and infrastructure</li> <li>Damage to crops and irrigation systems</li> </ul>	<ul style="list-style-type: none"> <li>Increased costs (protection schemes and clean-up)</li> <li>Loss of income from agriculture</li> </ul>

**Table 6: Primary and secondary impacts of Gizo's climate hazards.**



**Figure 10:** Map of Exposure to Climate Hazards for Gizo -- Gizo is exposed to multiple hazards such as water scarcity, drought, air temperature rise, and extreme rainfall.

Principal Climate Hazards	Women	Men	Children and Elderly
<b>Water scarcity and Drought</b>	<ul style="list-style-type: none"> <li>Women are primarily responsible for providing water for household use. Water scarcity and drought makes women have to walk farther to secure clean water. A large portion of women's time and energy is thus spent on traveling and waiting for water.</li> <li>Water deprivation has also been linked to violence against women, e.g. rape and sexual harassment when they have no option but to walk long distances unaccompanied (in some cases six kilometers per day round trip to collect water) (2011, Amnesty International Report).</li> </ul>	<ul style="list-style-type: none"> <li>For those who work in agriculture, water scarcity can threaten productivity and reduce family income.</li> </ul>	<ul style="list-style-type: none"> <li>Water scarcity often forces people to use unhygienic water, which may cause dysentery, diarrhea, cholera and skin problems. Children are particularly vulnerable.</li> <li>Children are often enlisted to support their mothers in seeking water. This can take up to 4 hours per day, usually in the evening, disturbing study time.</li> </ul>
<b>Temperature Rise (air)</b>	<ul style="list-style-type: none"> <li>For women an increase in temperature could increase their burden to do physical work (such as when seeking water).</li> <li>This could also mean spending more time taking care of family members that are more vulnerable to heat.</li> </ul>	<ul style="list-style-type: none"> <li>A rise in temperature affects agricultural productivity due to a higher incidence of plant diseases and fungal infections, which means reduced income for families.</li> <li>More spending on imported food.</li> </ul>	<ul style="list-style-type: none"> <li>Old people are more sensitive to high temperature.</li> </ul>
<b>Extreme rainfall</b>	<ul style="list-style-type: none"> <li>Extreme rainfall can cause damage to housing which increases the time that women have to spend cleaning and repairing the house, and increasing their risk due to damages.</li> <li>This hazard also increase the feel of anxiety of women about the safety of their children.</li> </ul>	<ul style="list-style-type: none"> <li>When extreme rainfall cause damage to house, men have the responsibility for the recovery or renovating the house. They going to do an extra work to be able to access building materials.</li> </ul>	<ul style="list-style-type: none"> <li>Children and the elderly have lower capacity to evacuate during extreme rainfall.</li> </ul>

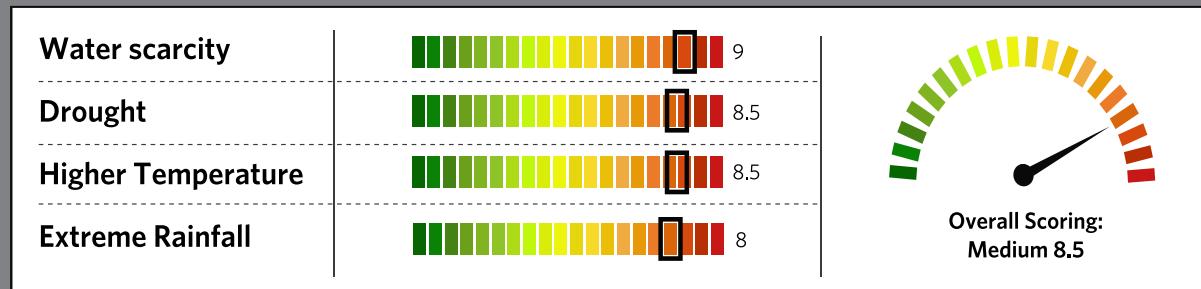
**Table 7: Gizo's Climate Hazard Impacts for Women, Men, Children and Elderly**

## SUMMARY OF EXPOSURE

Gizo is exposed to a number of natural hazards due to its location on the coastline and also its exposure to heavy rains and landslides. For the local population water scarcity, droughts, and temperature rise are the most serious hazards.

Other important climate hazards identified are extreme rainfall, high winds, and the indirect impacts of tropical cyclones.

Changing climate conditions have long-term impacts, which can significantly affect the economy, raise costs, and make entire communities more vulnerable.



# 6. SENSITIVITY

## 6.1. WHAT IS SENSITIVITY?

### Sensitivity means

***"the degree to which different systems and sectors of the population are affected by climate related hazards" (IPCC 2007).***

Understanding climate change sensitivity requires us to think not only about the geography of a place and its environmental characteristics, but also its socio-economic context. Sensitivity refers to all the *non-climate*, or the *man-made*, factors can influence a community's vulnerability. Some examples include the community's economy, levels of education, access to basic services, or the ways in which residents are organized.

These *non-climate* or *man-made* factors contribute to making it more difficult for people to prepare for, or recover from, a climate event, and this will lead to the community being more vulnerable to its damaging effects.

Sensitivity varies according to the characteristics of each community, whereas exposure may be very similar for places that are near one another.

For example, two villages that are located nearby each other will likely experience the same hazards. But their capacity to survive these hazards, is likely to be different because they will differ in terms of their social organization, levels of access to public services, livelihoods and preparedness.

### ***It is possible to reduce vulnerability to climate change by reducing a community's sensitivity.***

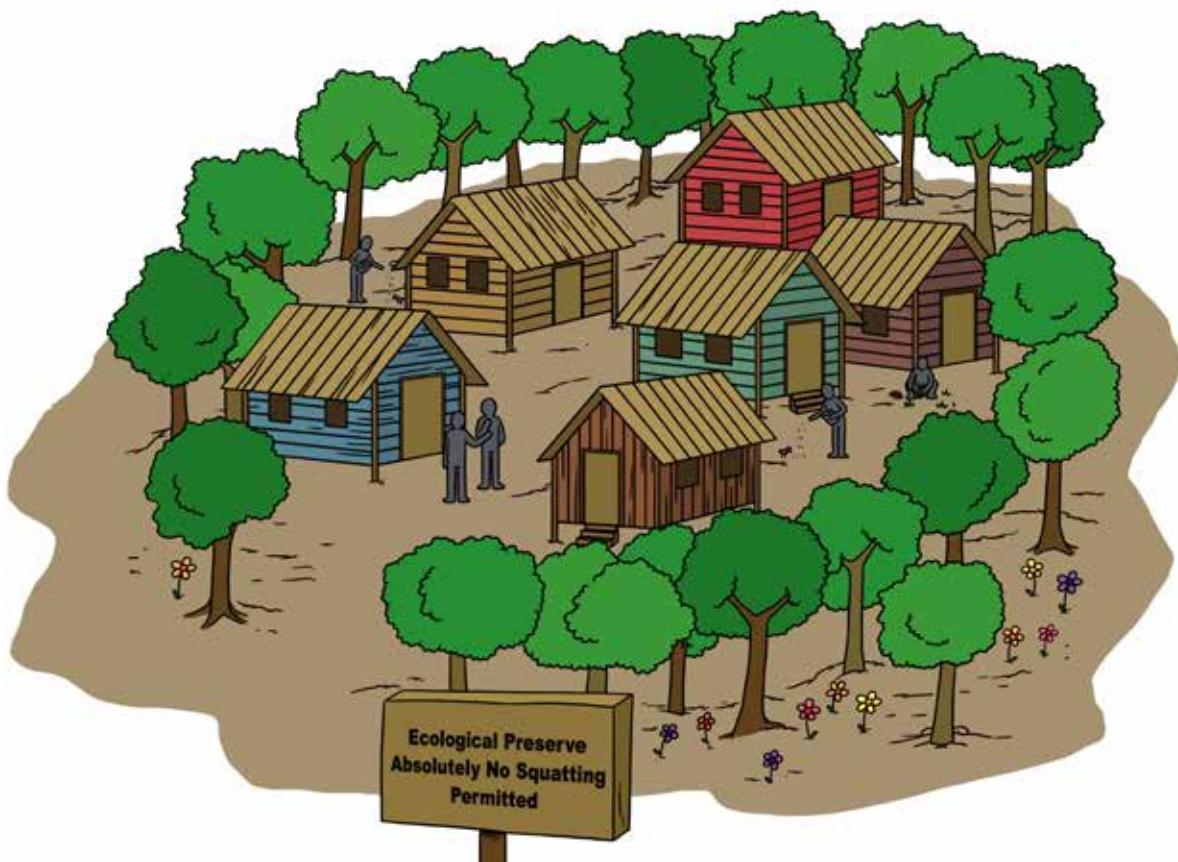
If both villages suffered from high winds, the one with housing near the coastline might be more damaged, while the other, with housing set back far from the beach might have been protected from harm. The village that has more connections to people working in the capital may be able to mobilize money and supplies to aid in recovery better than the isolated village. Therefore a number of *man-made* factors influence the sensitivity of people, communities or systems, to climate change.

It is possible to reduce vulnerability to climate change by reducing a community's sensitivity. In order to make community sensitivity more legible this CCVA classifies sensitivity into five categories, those are: (i) social, economic and demographic change, (ii) access, (iii) governance, (iv) social capital, and (v) capacity and awareness. By looking at sensitivity through each of these five lenses it is possible evaluate a community's relative strengths and weaknesses, and use them to identify opportunities to reduce vulnerability.

## 6.2. SENSITIVITY IN GIZO

### SOCIAL, ECONOMIC AND DEMOGRAPHIC CHANGE

There are many social, economic and demographic characteristics that influence a community's sensitivity to climate change, such as migration, the local economy, the management of natural resources, and barriers to growth. Demography relates to the profile of the population – for example the age of the people who live there, and their gender. Old people, for example, may be particularly affected by hot weather, so it is important to note if the proportion of older people is significant. Female-headed households often represent those with limited access to land, credit, income, and information to adapt to climate change hazards. The kinds of economic activity and livelihoods that sustain a community are also significant – sometimes livelihoods can be affected by changes in the climate – so having a diverse set of economic activities is important. A further example is the level of poverty of a community – if it is very poor households may have fewer options in adapting to climate change hazards, making them more vulnerable.



**Figure 11:** Lack of enforcement of regulations makes the community sensitive to climate hazards as it becomes increasingly challenging to manage natural resources, such as water sources that are needed to supply water to the community.

### In Gizo rapid urban growth of the provincial capital is driving unplanned development

Gizo is growing quickly and the rapid pace of change is making citizens more sensitive to climate change as the township struggles to respond to rising demand for housing, services, jobs and water. There are many factors behind Gizo's growth in recent years, these include migrants fleeing ethnic conflict and natural disasters, people seeking jobs, and also access to public services like healthcare and education. At the moment the government is challenged to keep up with growing demand and as a result certain public services have been overwhelmed, such as trash collection and water supply. Also newcomers are building new homes in available areas but in a disorderly manner, sometimes in conservation

areas and near water sources. To reduce sensitivity to the rapid change of the township the government needs to find ways to orient development, establish guidelines about public order, and find ways to provide services.

With rapid urban growth and the limited availability of services, such as proper healthcare, sanitation, and water supply, women face challenges in their role as caregivers -- taking care of children, the elderly and sick family members. Women often face the emotional stress having to cope with these challenges.



### What is needed?

- GOVERNMENT NEEDS TO FORMULATE REGULATIONS REGARDING THE ADEQUATE ADMINISTRATION OF THE WATER SUPPLY SYSTEM.
- GOVERNMENT ENFORCEMENT OF RULES AND REGULATIONS GOVERNING WHERE PEOPLE CAN SETTLE AND THE EFFECTIVE FUNCTIONING OF WATER SUPPLY SERVICE.
- INVESTMENT IN WATER SUPPLY INFRASTRUCTURE AND INSTITUTIONS TO ENSURE THAT THERE IS ADEQUATE SUPPLY FOR THE POPULATION.
- UPGRADING AND MAINTENANCE OF WATERSHEDS TO ENSURE SUFFICIENT RECHARGE OF WATER SUPPLY FOR THE URBAN AREAS.
- WOMEN'S NEEDS AND CONCERNs ARE INTEGRATED DURING THE CREATION OF RULES AND REGULATIONS, AS WELL AS IN MAKING INVESTMENT ON WATER SUPPLY INFRASTRUCTURE.

## ACCESS

Access is another factor that can influence sensitivity to climate change for local communities – both access to services, as well as physical access to places and people. When a community has limited access to public services, such as education, health services, or materials for fixing things, then the population can suffer greater impacts from climate hazards. For example it may have less information about climate hazards, less medicine to combat illnesses, or fewer materials to fix water supply assets and infrastructure.

Access can also relate to the degree of isolation and ease of movement to other places. If a community is isolated it is difficult to reach in times of need, or if they need materials or services; if for example the community needs to fix water pumps or storage tanks if the needed resources are too far away they are vulnerable. Thus isolation can increase sensitivity in times of need.

### ***In Gizo the lack of public services means survival of the fittest***

As Gizo has grown in size there has not been a reliable water supply service that can respond to this growing demand; as a result households have been forced to secure water on their own. While this has solved short-term needs to access water, it has posed problems for the creation of larger-scale, communal water supply systems – at the moment there is little sense of collective ownership and responsibility in the management of water resources. Part of the problem has been limited government authority, which lacks a clear mandate and sufficient resources, to manage water for a fast-



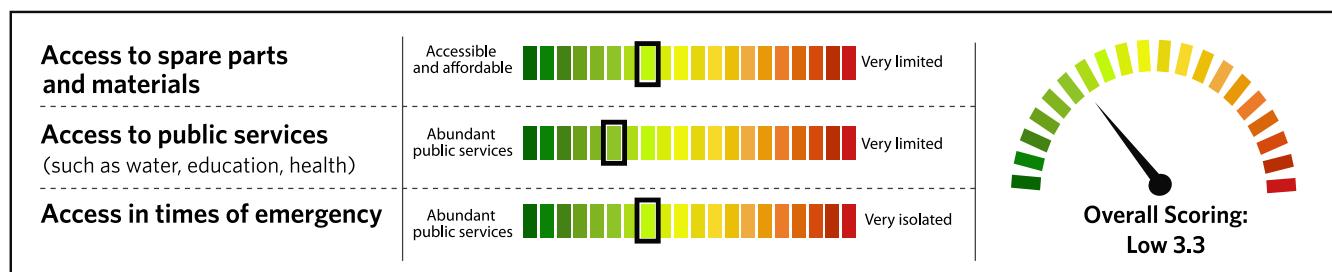
**Figure 12:** Lack of access to water has pushed some community members to tap into water pipes to channel water to their homes. Illegal tapping compromises the water supply system for other people.

growing urban center experiencing high demand. There are also no clear regulations about how households should manage water use. But there is also low awareness about how water is a shared resource and the important role of newly formed water committees.

Pollution and decreased water supply due to droughts is contributing to an increase in the risk of contracting illnesses such as diarrhea. These kinds of illnesses mostly affect children who have weak immunity. The Provincial hospital and health centers are also affected by the lack of water which can also escalate health risks amongst children.

The lack of adequate governance of water resources is making people more sensitive to climate change, especially to water shortages; it means that this scarce resource is less likely to be well administered by the government. In order to improve governance both leadership is needed, from the government (in the form of a competent authority, skilled technicians, clear regulations, and adequate infrastructure), as well as the cooperation of residents, NGOs, church groups, and the private sector (in the form of water committees, households following regulations, and constant communication). This will help ensure the sustainable management of water for years to come.

In Gizo women are the ones primarily responsible for providing water for household use, while children and husbands also provide help. With emerging issues such as the increasing number of newcomers and increasing demands for water, women bear additional responsibility to physically locate and access water sources as they commute farther, and during odd hours, to secure clean water.



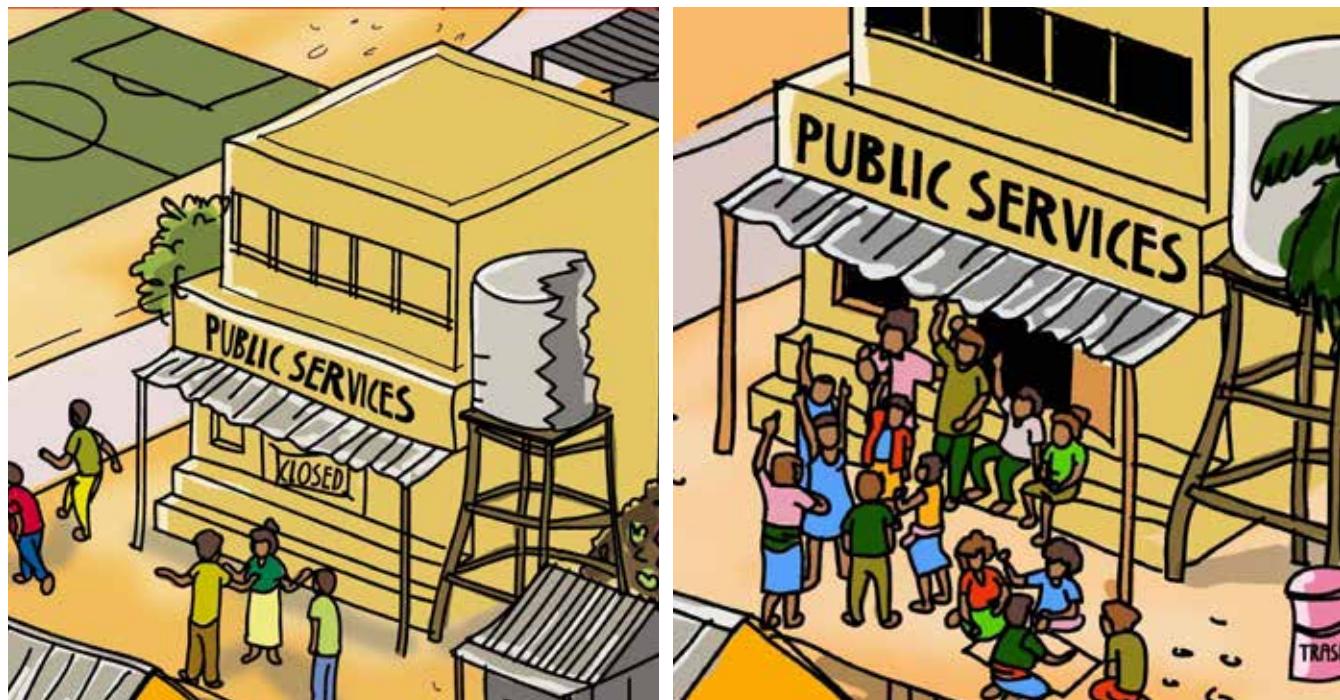
## What is needed?

- GOVERNMENT ACQUIRES LAND ALONG PIPELINES, OR IN WATERSHED AREAS THAT REQUIRE CONSERVATION, SO THAT GIZO'S WATER SUPPLY SYSTEM CAN BE PROTECTED.
- PROVINCIAL GOVERNMENT DEVELOPS WITH THE WATER COMMITTEES A CLEAR SET OF REGULATIONS ABOUT HOUSEHOLD WATER USE THAT IS WIDELY DISSEMINATED.
- PUBLIC OUTREACH CAMPAIGNS TO PROMOTE AWARENESS AND DIFFERENT ATTITUDES TOWARDS WATER USE BY THE POPULATION.
- TRAINING TO SUPPORT BETTER LOCAL TECHNICAL CAPACITY TO MANAGE AND MAINTAIN LOCAL WATER SUPPLY SYSTEMS.
- MORE RESOURCES TO SUPPORT INCREASING INFRASTRUCTURE AND DELIVERING ADEQUATE PUBLIC SERVICES.
- CONSULTATION AND COORDINATION WITH BOTH MEN'S AND WOMEN'S GROUPS TO ENSURE THEIR ACTIVE PARTICIPATION IN SHARING INFORMATION AND DECISION-MAKING.

## GOVERNANCE

Governance refers to the relationship that citizens have with their government and the process in which the government manages public resources, takes decisions, and implements them. Poor governance describes poor enforcement of laws, the lack of engagement of government officials with people, and poor administration of public funds and resources. Good governance refers to effective processes of decision-making in which citizens and government work closely together, due to trust and communication.

Good governance is important in managing water supply because it helps to ensure that water can be distributed to meet the needs of the entire community, not just a select group. Good governance often results in durable and fair institutions, these can ensure that the administration and maintenance of water supply is effective and sustainable. Poor governance may result in a lack of enforcing regulations that protect water resources, a lack of information about regulations, or even a lack of trust in the government to administer water fairly.

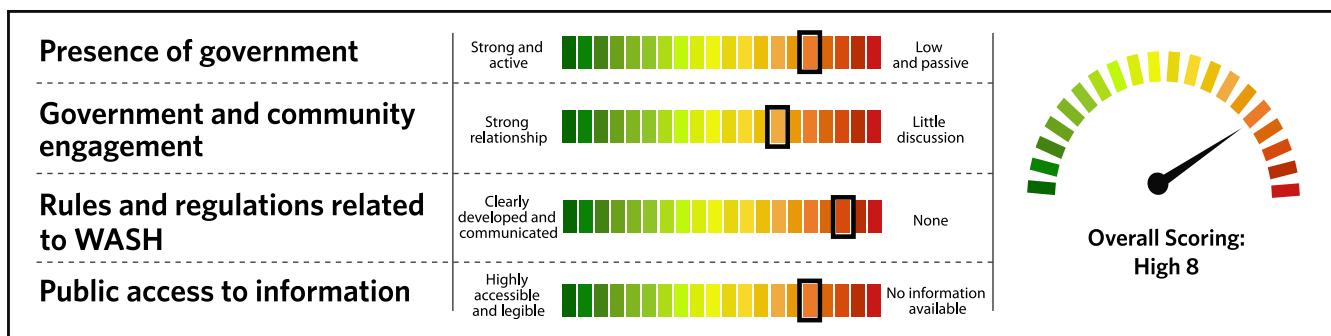


**Figure 13:** Poor governance occurs when public service providers do not meet to discuss issues with citizens, nor make information available to them (left). Good governance occurs when public service providers engage with citizens, are able to listen to their needs, and respond to them (right).

## **A lack of clarity from the Provincial Government is confusing and has led to a lack of enforcement.**

Despite the decentralization of powers to the provincial level in Gizo there has not yet been an adequate transfer of powers to the Provincial level to empower a local institution to manage water resources adequately. Without an institution capable of doing so, that communicates its own responsibilities and those of residents, there remains uncertainty about who is in charge of managing water resources and regulations. Good governance requires this clear delegation of tasks, and mechanisms for citizens to be able to interact with government to address problems. But at the moment the necessary ordinances and technical expertise are not in place in Gizo and this makes it challenging for the Public Works division to administer and manage a complex and large water supply system. People also don't know what is going on, and there are others who, due to this lack of authority and enforcement, are vandalizing public assets and undermining the system - this confusion is making Gizo more sensitive to climate hazards.

To reduce sensitivity leadership and good governance measures are needed, this involves both proactive response from the government agencies and institutions, as well as engagement from citizens. However, despite being responsible for fetching water and meeting household needs, women, and other minority groups such as the disabled and the elderly, are often excluded from planning and decision-making processes. On the government side there is a need for a capable institution mandated to manage water for the township; as well as legislation and rules clearly defining how water can be accessed and managed. Citizens should also have an understanding about how to follow regulations and who to seek assistance from. Engagement with citizens in managing water resources, especially women and minority groups, is critical to achieve good governance goals.



### **What's needed?**

- PROVINCIAL GOVERNMENT REQUIRES A CLEAR ROLE OF WHAT ITS RESPONSIBILITIES ARE.
- PROVINCIAL GOVERNMENT CAN EMIT NEW RULES, REGULATIONS AND ORDINANCES GOVERNING PROPER WATER USE.
- NATIONAL GOVERNMENT SHOULD PROVIDE THE NECESSARY INCENTIVES TO ENCOURAGE PRIVATE SECTOR INVESTMENT IN GIZO'S WATER SUPPLY SYSTEM, FOR EXAMPLE THE STATE-OWNED ENTERPRISE SOLOMON WATERS, PREVIOUSLY KNOWN AS SIWA, WHICH HAS THE CAPACITY TO RUN A WATER SUPPLY SERVICE.
- THE INSTITUTION MANAGING WATER SUPPLY IS ENDOWED WITH SUFFICIENT FINANCIAL AND HUMAN RESOURCES TO ACHIEVE ITS MANDATE.
- THE CREATION OF CHANNELS FOR CITIZENS TO RECEIVE INFORMATION AND SEEK ACCOUNTABILITY ABOUT WATER, TO ENCOURAGE MORE ACCOUNTABILITY AND PUBLIC ENGAGEMENT.
- LANDOWNERS AND TRIBES WHO OWN OR OCCUPY LAND WHERE THE WATER SUPPLY INFRASTRUCTURE OR WATERSHEDS, ARE LOCATED ARE INVOLVED IN THE PLANNING PROCESS AND IN EFFORTS TO DISSEMINATE REGULATIONS.
- WOMEN ARE FULLY ENGAGED IN THE PLANNING AND DECISION-MAKING PROCESS SO THAT THEY CAN ENSURE THE ADEQUATE IMPLEMENTATION OF RULES AND REGULATIONS FOR WATER GOVERNANCE.

## SOCIAL CAPITAL

Social capital refers to the strength of relationships between community members that enables them to work together towards a common goal. A community that possesses good social capital may be one where households have close reciprocal relationships, there is good leadership, effective means of sharing information, and there is peace and security. A community with low social capital may be one where people distrust each other, there are few communal activities involving different groups, people don't communicate freely with one another, and there is crime and insecurity.

Social capital is an important factor in communities that effectively manage water resources because it can help them to circulate information about water rationing and effective water management, help to distribute scarce water resources evenly, and ensure collaboration in maintaining water supply infrastructure.

### ***In Gizo citizen participation is needed to foster more collaborative management of water supply***

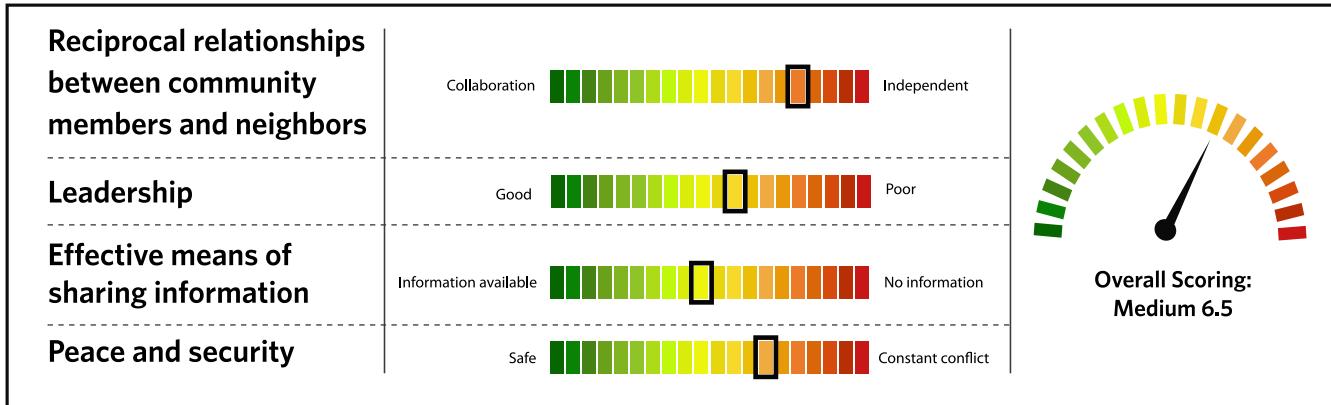
Gizo is a complex society made up of a number of different ethnic groups from the surrounding region, and mounting tensions between more established residents and newcomers who are settling at the fringes of the city. Differences between groups may undermine efforts to coordinate actions to improve water supply efforts and enforce regulations.

Different from rural areas and small village communities larger urban areas, such as Gizo, are more complex and water supply systems are vast. They are better coordinated by a government body and regulated through regulations, laws and a bureaucratic system because the management challenges are so great. At the moment many households and communities in Gizo are acting independently to resolve water shortage issues, not through collective action or in a coordinated matter; for example tapping into government water supply pipes. This undermines collective efforts, that are led by the government, to ensure water access for all. This lack of collaboration makes Gizo more sensitive to climate change hazards such as drought and heavy rainfall

Previously there were no opportunities for citizens to collaborate to share information, maintain infrastructure, and ensure that service delivery was optimal. Now however there is a citizen water committee, called the Project Pilot Committee, made up of a number of representatives from different community and government institutions, who meet regularly. If this water committee can continue to grow and inform households and communities of the need to follow rules and regulations then more people will be informed. Community support and participation are required.



**Figure 14:** Social capital is an important characteristic of a resilient community, it allows information to be circulated amongst community members, for people to work together, and support each other in times of need.



### What is needed?

- THE NEW WATER COMMITTEE CAN REACH OUT AND WORK WITH EACH OF THE SEVEN ZONES, SENDING INFORMATION AND INVOLVING THEM IN OUTREACH ACTIVITIES.
- WHERE THERE ARE DIFFERENT ETHNIC GROUPS NEW REGULATIONS CAN BE TRANSLATED TO DIFFERENT LANGUAGES AND OUTREACH CAN BE BETTER ADAPTED TO SUIT LOCAL COMMUNITIES.
- TRAINING AND SUPPORT TO BUILD A STRONG WATER COMMITTEE THAT IS ACTIVELY ENGAGED AT THE COMMUNITY AND GOVERNMENT LEVEL.
- THE INCLUSION OF WOMEN, CHILDREN, PEOPLE WITH DISABILITIES AND THE ELDERLY IN WATER COMMITTEES, DOING SO CAN HELP PRIORITIZE THEIR NEEDS, AND ENSURE THAT WATER SYSTEMS ARE MORE SENSITIVE TO THEIR INTERESTS.
- RAISING PUBLIC AWARENESS, THROUGH THE WATER COMMITTEE, AND IN PARTNERSHIP WITH NGOS, CIVIL SOCIETY, AND WOMEN'S GROUPS, ABOUT THE NEED FOR COLLECTIVE EFFORTS AND CO-OWNERSHIP OF WATER SUPPLY INFRASTRUCTURE.
- THE INCLUSION OF ALL COMMUNITY GROUPS, INCLUDING THE MARGINALIZED, IN THE DISCUSSION OF COMMUNITY ISSUES.
- CHURCH LEADERS CAN WORK TOGETHER TO FORM A JOINT PLATFORM TO PROMOTE AWARENESS.

## CAPACITY AND AWARENESS

*Capacity* refers to the skills and abilities of a community, to solve problems and develop solutions; *awareness* refers to the knowledge that community members may have about rules and situations in the community. These are two important factors in reducing vulnerability to climate hazards. Good capacity allows local communities to resolve issues themselves by taking action, without necessarily waiting for external support. Good awareness allows local communities to react to events, and know what actions need to be taken, or when they need to be taken. Low capacity and awareness make communities sensitive to climate hazards because they have few skills or knowledge about problems or issues that are happening around them.

Good capacity can support the maintenance of effective water supply systems, for example with skills like fixing broken parts, or doing maintenance checks. Good awareness can translate into communities that know about proper hygiene, how to ensure clean water, and how to ensure households stay safe and healthy.

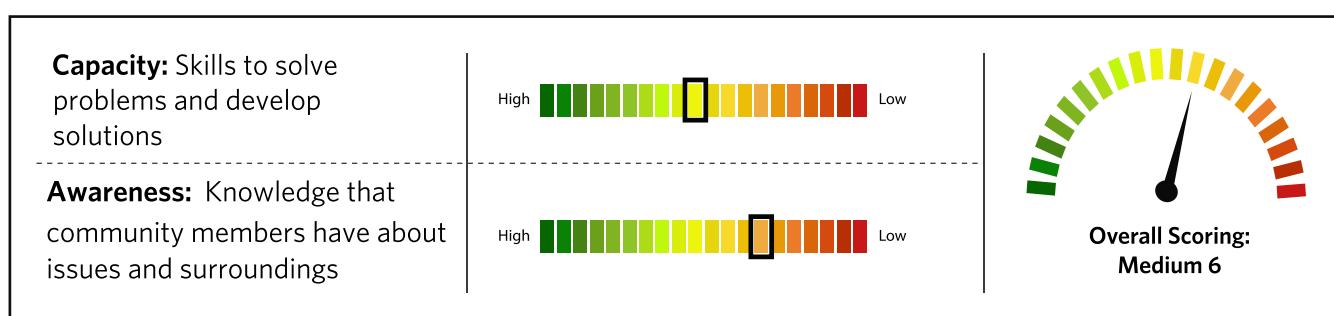
## **Gizo's water supply is hard to manage due to a lack of clear regulations and oversight**

Ensuring constant water supply in Gizo requires effective water capture and the channeling of water to customers – but unplanned housing built on hillsides in conservation areas, vandalism of water supply infrastructure, as well as illegal connections to pipes, weaken collective water management efforts. One example is in Banana Valley, one of Gizo's eight watersheds, where new settlers are building homes close to the water source, and connecting household supply lines directly. This is problematic because houses located there reduce water catchment for others and threaten pollution of water sources. This can make the entire community more sensitive in the event of water shortages since there are few alternative sources.

To reduce sensitivity more awareness and enforcement of regulations is needed – for example, residents as well as newcomers should be aware of rules prohibiting building housing in restricted areas. Government should do more to either communicate regulations, in a way that is clear and communicable, or create them if they are missing. Effective enforcement of regulations is also very important and requires rules the involvement of local authorities such as the police and disseminated to the public through water committee and other citizen organizations. Following regulations will not only improve the functioning of water systems, but it will also mean that more people can benefit from public resources because they can be shared better. In addition different groups, such as women, the disabled, the elderly, and children, have differing access to information. It is important that rules and regulation are communicated in ways that are accessible to all, despite varying age, educational levels, and levels of access to information.



**Figure 15:** When information is made available to community members they are more likely to follow regulations, understand government efforts to improve water systems, and be well informed.



### **What is needed?**

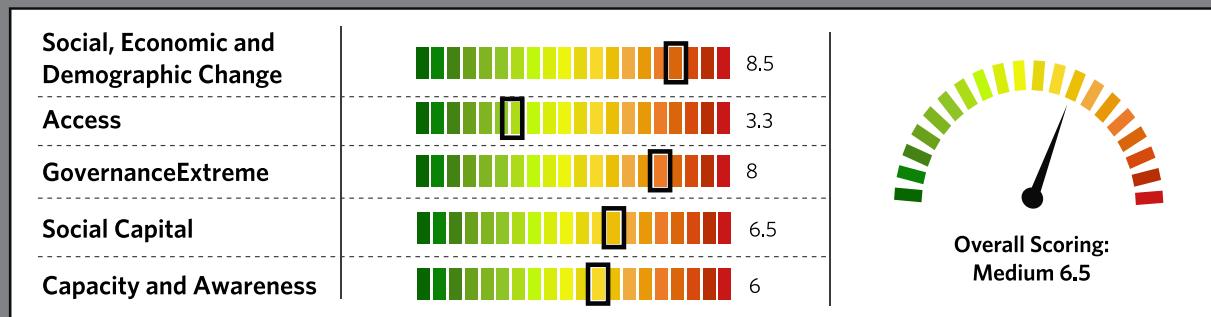
- INVOLVEMENT OF LOCAL AUTHORITIES AND THE POLICE TO PLAY A MORE ACTIVE ROLE IN THE ENFORCEMENT OF LOCAL REGULATIONS.
- CLEAR SIGNAGE AND FENCING OF AREAS WHERE ILLEGAL HOUSING AND TAPPING OF PIPES IS PROHIBITED.
- CIVIL SOCIETY MOBILIZED AND AWARE OF RULES GOVERNING WATER SUPPLY
- RESIDENTS, THROUGH WATER COMMITTEES, ARE WORKING TOGETHER WITH GOVERNMENT AND CONTRIBUTING TO PLANNING AND WATER IMPLEMENTATION MEASURES.
- COMMUNICATION OF RULES AND REGULATIONS TO A VARIETY OF DIFFERENT GROUPS IN GIZO. THE MESSAGES SHOULD BE SIMPLE AND EASY TO UNDERSTAND AND APPLICABLE TO DIFFERENT GROUPS.

	<b>ISSUE</b>	<b>SCORE</b>
<b>Social, Economic and Demographic Change</b>	<ul style="list-style-type: none"> <li>• Fast-growing population</li> <li>• Rising demand for water beyond current public capacity to supply</li> <li>• Anarchic supply measures reduce capacity of system</li> </ul>	<b>High</b>
<b>Access</b>	<ul style="list-style-type: none"> <li>• Lack of capacity to supply water to the population</li> <li>• Low awareness that water is a shared resource, leading to self-serving behavior Lack of clear regulations and resources to manage scarce resources</li> <li>• Women and children walk longer distances to fetch water and face challenges to secure drinking water.</li> <li>• Limited water resources further constrain women's access to clean water.</li> </ul>	<b>Low</b>
<b>Governance</b>	<ul style="list-style-type: none"> <li>• Lack of technical capacity to manage water</li> <li>• Citizens lack awareness of regulations regarding where to build housing in watershed areas</li> </ul>	<b>High</b>
<b>Social Capital</b>	<ul style="list-style-type: none"> <li>• Citizen awareness low and not collaborative with government</li> <li>• Need to promote actions of water committee</li> </ul>	<b>Medium</b>
<b>Capacity and Awareness</b>	<ul style="list-style-type: none"> <li>• Limited technical capacity to manage water supply system</li> <li>• Low capacity of citizens to mobilize for better water services</li> </ul>	<b>Medium</b>

**Table 7: Sensitivity in Gizo**

## SENSITIVITY SUMMARY

Gizo's overall sensitivity is medium, this evaluation helps to give clear direction as to how different factors can be addressed, to reduce sensitivity.



Some of the key points are:

- **PLANNING FOR GROWTH:** GIZO IS BECOMING MORE SENSITIVE AS IT GROWS IN SIZE BECAUSE NEW SETTLERS THREATEN WATER SOURCES AND CONSERVATION AREAS, AND ALSO DEMAND OUTSTRIPPING SUPPLY. ADEQUATE PLANNING CAN REDUCE SENSITIVITY BY INDICATING WHERE DEVELOPMENT IS SENSIBLE AND DOESN'T NEGATIVELY AFFECT WATER.
- **REGULATIONS AND ENFORCEMENT:** LOCAL LAWS AND ORDINANCES ARE NEEDED TO INDICATE HOW WATER SUPPLY IS BEST MANAGED. DEMONSTRATING GOOD ENFORCEMENT AND REGULATORY ENVIRONMENT CAN HELP ATTRACT PRIVATE INVESTORS AND EXPAND THE SYSTEM.
- **GOOD GOVERNANCE OF WATER RESOURCES:** DEFINING CLEARLY THE ROLES AND RESPONSIBILITIES OF PROVINCIAL, LOCAL AND COMMUNITY INSTITUTIONS WILL HELP INDICATE EXPECTATIONS OF WHO SHOULD BE MANAGING WATER SUPPLY SERVICES.
- **PUBLIC AWARENESS AND PUBLIC CAMPAIGNS:** CAMPAIGNS TO RAISE PUBLIC AWARENESS ARE NEEDED, TO IMPROVE CONSERVATION MEASURES AND CHANGE BEHAVIOR.
- **GENDER MAINSTREAMING:** IT IS IMPORTANT TO INCLUDE THE INTERESTS OF WOMEN, CHILDREN AND OTHER DISADVANTAGED GROUPS IN ACTIVITIES SUCH AS: DRAFTING LOCAL LAWS, COORDINATING WITH COMMUNITY MEMBERS ABOUT WATER CONSERVATION, SHARING INFORMATION, AND MAKING DECISIONS ABOUT WATER RESOURCE MANAGEMENT.

# 7. ADAPTIVE CAPACITY

## 7.1. WHAT IS ADAPTIVE CAPACITY?

**Adaptive Capacity refers to**

*"the ability of a system to adjust to climate change so as to moderate potential damage, take advantage of opportunities, or help cope with consequences" (IPCC 2007).*

Throughout history people throughout the world have been responding to climate change, doing so has helped ensure their survival and prosperity. Across the world communities have had to make adjustments to the ways they organize themselves, the way they sow their crops, build their homes, and manage their resources, because weather patterns have never been totally constant. So communities have shown adaptive capacity for a long time.

Adaptive capacity is a term given to the ways that people are able to respond to climate change to reduce their own vulnerability. It is important to remember that another way to reduce vulnerability, other than reducing sensitivity, is to increase a community's adaptive capacity.

## 7.2. ADAPTIVE CAPACITY IN GIZO

### AUTONOMOUS / HOUSEHOLD-LEVEL

Autonomous adaptive capacity refers to actions taken at individual or households level to protect livelihoods and assets from potential climate related hazards. Autonomous adaptation is usually small scale and effective for low intensity disasters. Adaptation is triggered by ecological changes in natural systems and by market or welfare changes in human systems.



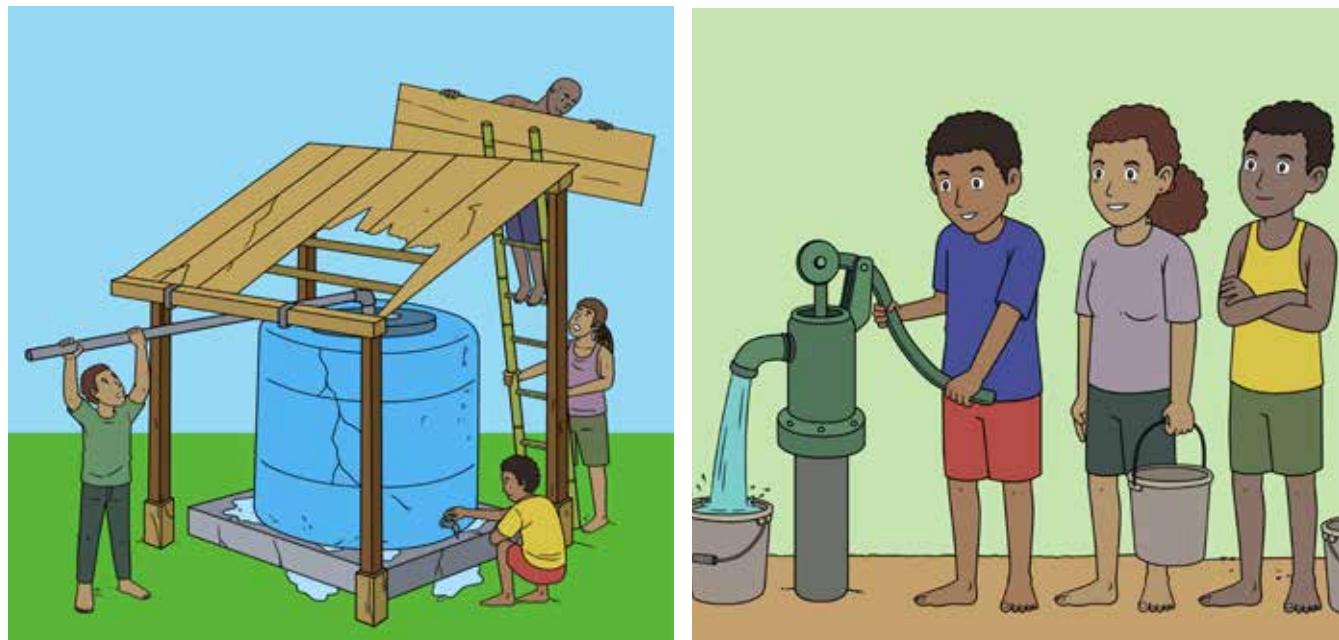
**Figure 16:** Measures taken at the household-level to raise awareness are essential for community efforts to reduce vulnerability. Adopting practices such as household capture and conservation of water are an example of adaptive capacity that, if practiced widely, can benefit the

## **Positive:**

- HOUSEHOLD-LEVEL WATER CONSERVATION TECHNIQUES ARE PRACTICED BY SOME HOUSEHOLDS, SUCH AS THE SEPARATION AND REUSE OF RAINWATER FOR WASHING OR HOUSEHOLD TASKS. SOME ARE ALSO HARVESTING RAINWATER DURING PERIODS OF HEAVY RAIN TO SUPPLEMENT THEIR WATER SUPPLY.
- SOME HOUSEHOLDS MINIMIZE THE MISUSE OR OVERUSE OF WATER BY UTILIZING SIMPLE PRACTICES SUCH AS USING SEPARATE DISHES FOR RINSING AND WASHING OF COOKING UTENSILS AND USING LEFT OVER WATER FROM THE BATH OR WASTE WATER TO FLUSH THE TOILET.
- OTHER STRATEGIES INCLUDE IMPOSING RULES ON THE USE OF DOMESTIC WATER, SUCH AS LIMITED USE DURING DROUGHTS OR FOR DRINKING ONLY. SUCH HOUSEHOLD-LEVEL TECHNIQUES SUPPORT BEHAVIOR CHANGE IN THE HOME AND BEYOND, THEY CAN ALSO HELP POSITIVELY INFLUENCE OTHER COMMUNITY MEMBERS.

## **Negative:**

- HOUSEHOLDS INCREASINGLY USE THEIR OWN WATER SUPPLY MECHANISMS (THROUGH RAINWATER HARVESTING) BECAUSE PUBLIC SYSTEMS DON'T WORK AND THUS DISREGARD COMMUNITY REGULATIONS, SUCH AS WHERE TO BUILD HOUSES AND PROTECT NATURAL WATERSHEDS.



**Figure 17:** Community-level adaptive capacity means that residents have the skills to maintain water supply infrastructure (left) and know how to manage distribution of water (right), which can be as simple as managing lines.

## **What is needed?**

- MORE RESPONSIBLE USE OF WATER IN EACH HOUSEHOLD, THROUGH BETTER LEVELS OF AWARENESS AND RATIONING IN TIMES OF WATER SCARCITY. IMPROVING HOUSEHOLD MANAGEMENT MAY ALSO REQUIRE INVESTMENTS IN WATER TANKS.

## COLLECTIVE/ COMMUNITY-LEVEL

Collective adaptive capacity refers to the capacity of or actions taken by groups. These are generally community initiatives aimed at reducing exposure or minimizing sensitivity, the efforts and benefits of which are sought after by a wider group than just individual households. Collective adaptation is geographically larger than autonomous adaptation and usually requires more resources and coordination.

### Positive:

- AT THE COMMUNITY LEVEL THERE ARE NOW NEW CITIZEN INSTITUTIONS THAT ARE HELPING MANAGE LOCAL SERVICES SUCH AS THE SOLID WASTE COMMITTEE AND THE NEW WATER COMMITTEE INITIATED BY SIWSAP. THESE CIVIL SOCIETY COMMITTEES RAISE AWARENESS AND DEMONSTRATE CITIZEN INITIATIVE IN ENGAGING IN MANAGING COMMUNITY RESOURCES.
- OTHER SOCIAL LEADERS SUCH AS CHURCH LEADERS ARE ALSO PARTICIPATING IN ADVISING CITIZENS ABOUT THE IMPORTANCE OF WATER USAGE. THIS KIND OF LEADERSHIP CAN HELP BUILD SOCIAL CAPITAL AND TRANSMIT IMPORTANT SOCIAL NORMS TO THE REST OF THE COMMUNITY, SUCH AS FOLLOWING RULES AND REGULATIONS.
- WOMEN-SAVING GROUPS EXIST THAT HAVE BEEN FORMED BY THE GIZO ENVIRONMENT LIVELIHOOD GOVERNANCE ASSOCIATION (GELCA), IN ORDER TO EMPOWER WOMEN ECONOMICALLY. WOMENS' SAVING GROUPS AND COLLECTIVE SCHEMES HAVE THE POTENTIAL TO STRENGTHEN FAMILY'S ECONOMIC WELL-BEING AND IMPROVE COMMUNITY RESOURCE MANAGEMENT.



**Figure 18:** Community social organizations, such as neighborhood associations, church groups, and women's savings groups, are all indicators of community adaptive capacity. They can help to mobilize community collaboration and circulate important information to reduce vulnerability.

### Negative

- VISITORS COMING TO THE ISLAND TO TRADE AT THE MARKET OFTEN DON'T RESPECT LOCAL REGULATIONS, DEFECATING IN THE OPEN AND THROWING TRASH ON THE GROUND.



**Figure 19:** When local regulations are not respected, for example when people throw trash in areas where they aren't allowed to, it demonstrates poor adaptive capacity. This is because it means that people are not following regulations and acting in the public interest.

### What is needed?

- A FULLY ACTIVE AND CAPABLE CLIMATE CHANGE AND WATER COMMITTEE THAT IS ABLE TO DISSEMINATE INFORMATION TO ALL THE DIFFERENT ZONES AND GATHER INFORMATION FROM THE COMMUNITY.
- MORE SHARING OF INFORMATION TO MAKE IMPORTANT WATER CONSERVATION INFORMATION AVAILABLE TO THE PUBLIC; ESPECIALLY USING INFORMATION BOARDS AND OUTREACH.
- SINCE COMMUNITY MEMBERS HAVE IMPORTANT ROLES IN IMPLEMENTING ADAPTATION EFFORTS, FURTHER ENGAGEMENT AND ASSISTANCE FOR COMMUNITY GROUPS (E.G. WOMEN GROUPS) WILL BE NEEDED TO STRENGTHEN THEIR ROLE IN LOCAL RESOURCE MANAGEMENT (FOR EXAMPLE IN MANAGING SMALL-SCALE WATER SUPPLY SYSTEMS, RAIN HARVESTING SYSTEM, OR MAINTAINING OTHER CLIMATE-RESILIENT INFRASTRUCTURE).

## INSTITUTIONAL / GOVERNMENT

Institutional adaptive capacity refers to the capacity of organizational systems. These might be programs, policies, regulations, human resources and technological expertise of government at the local, regional or national levels, as well as civil society groups.

### Positive:

- NATIONAL AND PROVINCIAL GOVERNMENT HAVE EMITTED WATER ORDINANCES RELATED TO WATER AND SANITATION (ALTHOUGH MORE ARE NEEDED) AND HAVE MADE THE LINK BETWEEN CLIMATE CHANGE ADAPTATION PLANS AT THE NATIONAL AND LOCAL LEVELS.

### Negative:

- BUT THERE ARE ALSO LIMITS TO THE EXTENT TO INSTITUTIONAL EFFORTS FOR ADAPTATION, FOR EXAMPLE INFORMATION BROADCAST ON RADIOS IS NOT ALWAYS RECEIVED, AND SOME WELFARE PROGRAMS ARE NOT SUCCESSFUL AT REACHING THE MOST VULNERABLE AND ISOLATED.



**Figure 20:** The government plays an important role in increasing adaptive capacity, for example by promoting replanting of deforested areas and improved natural resource management, as well as improving educational and health facilities.



**Figure 21:** If governments are not creating and enforcing regulations about building standards, or ensuring the maintenance of water supply infrastructure, this displays poor adaptive capacity. Enforcement is needed to reduce vulnerability from climactic hazards.

### What is needed?

- MORE LEADERSHIP FROM NATIONAL AND PROVINCIAL GOVERNMENTS TO PUSH FOR REFORM IN THE CURRENT ADMINISTRATIVE PROCEDURES TO ENSURE THAT SUFFICIENT HUMAN AND FINANCIAL RESOURCES ARE ALLOCATED TO GIZO AND INSTITUTIONAL MEASURES ARE IN PLACE TO ENSURE WATER SUPPLY FUNCTIONS.

## SUMMARY OF ADAPTIVE CAPACITY

Overall adaptive capacity for Gizo is medium. Adaptive capacity refers to the capacity, skills and organization that a community possesses to reduce vulnerability to climate change. There are actions at the household, community and institutional levels that can be done to increase adaptive capacity.



Some of these are:

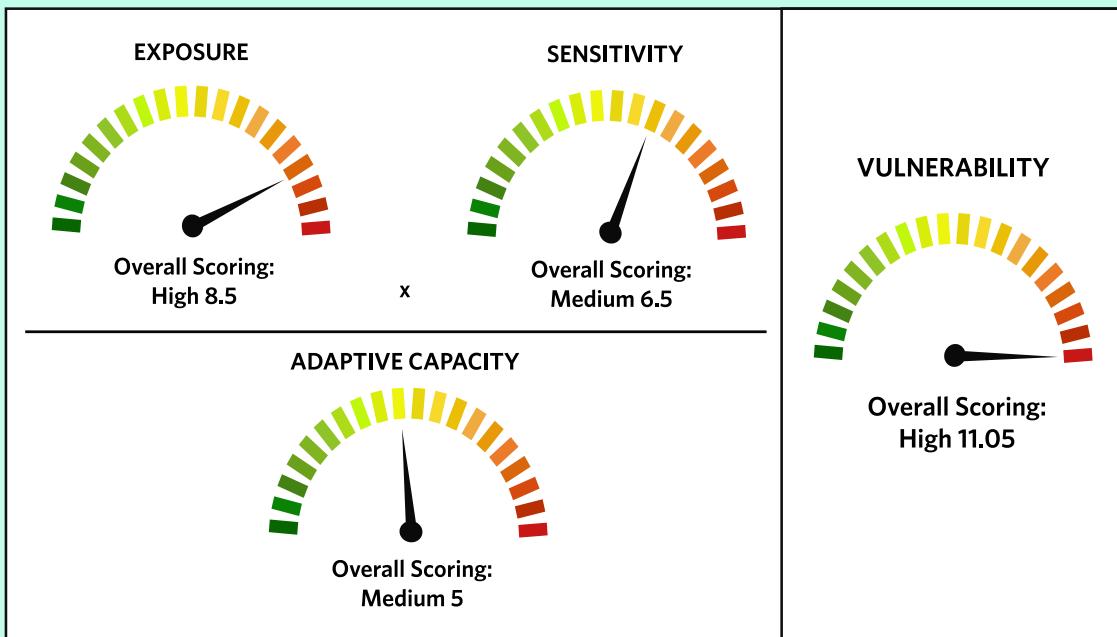
- HOUSEHOLDS ARE MORE INFORMED ABOUT WATER CONSERVATION MEASURES AND HAVE MORE INFORMATION AND GUIDANCE ABOUT REGULATIONS GOVERNING WATER MANAGEMENT.
- WATER COMMITTEES, IN EACH ZONE, COORDINATE AND COMMUNICATE WITH THE GIZO CLIMATE CHANGE AND WATER COMMITTEE TO SHARE INPUTS INTO PLANNING AND MANAGEMENT, AND DISSEMINATE INFORMATION TO HOUSEHOLDS.
- GOVERNMENT AGENCIES AND THE POLICE DEPARTMENT ENFORCE REGULATIONS, EMITTED FROM THE PROVINCIAL GOVERNMENT.

## 8. VULNERABILITY

Vulnerability refers to the extent to which individuals or communities are negatively affected by hazards - such as water scarcity and heavy winds in the case of the Solomon Islands. Understanding vulnerability is important because it helps people become aware of the hazards to which they are exposed. Being more aware of vulnerability also encourages people to change their behavior, if necessary, and make their families safer.

Vulnerability is usually calculated using the following equation:

$$\text{Vulnerability} = \frac{\text{Exposure} \times \text{Sensitivity}}{\text{Adaptive Capacity}}$$



While in this CCVA we are not calculating exact quantities or levels of either of these indicators, what is important to understand is that vulnerability can be reduced by reducing Sensitivity, and/ or increasing Adaptive Capacity.

Vulnerability can be thought about in many different ways; one of the key aspects that this report will look at is the different ways in which vulnerability is distributed - who are the most vulnerable people, where they live and work, and what community systems are most at risk? Vulnerability can also be interrelated, where exposure to one kind of vulnerability (for example physical harm, also relates to their economic standing) so it is important to think about how different hazards and situations often relate to one another.

The CCVA is designed to support an adaptive planning process, we thus present two different future scenarios that can help support discussion and reflection on how measures can be taken to move communities towards a more resilient future. At the end of this chapter we present two possible scenarios for the medium- to long-term future, both have been developed with the help of community members thinking about current issues and trends, and projecting them forward.

## **8.1. VULNERABILITY IN GIZO**

Gizo is one of the country's largest townships it is undergoing changes due to its growing population, but this growth is not accompanied by an increase in government or capacity to manage expanding public services.

## **8.2. VULNERABLE PEOPLE, PLACES AND SYSTEMS**

Vulnerability can be understood differently through a number of perspectives. To challenge us to think about it from a variety of dimensions, and ensure that we are considering all aspects of a community's well being, we are going to reflect upon vulnerability in terms of *Where?* *Who?* and *What systems?* are the most critical.

Following examination of the survey data, interviews and focus group discussions the following people, places and systems were identified as those being most vulnerable to the impacts of climate change, in particular in relation to WASH.

### **Vulnerable People**

In the same way that climate hazards are not distributed evenly across the township or village, different groups of people can also be more susceptible, or vulnerable, to climate hazards than others. For example, the elderly and the young are more likely to suffer from extreme weather conditions, and are less likely to be able to evacuate an area during a disaster without assistance. Identifying which groups are more vulnerable than others can inform what measures will support them in the face of future climate hazards.

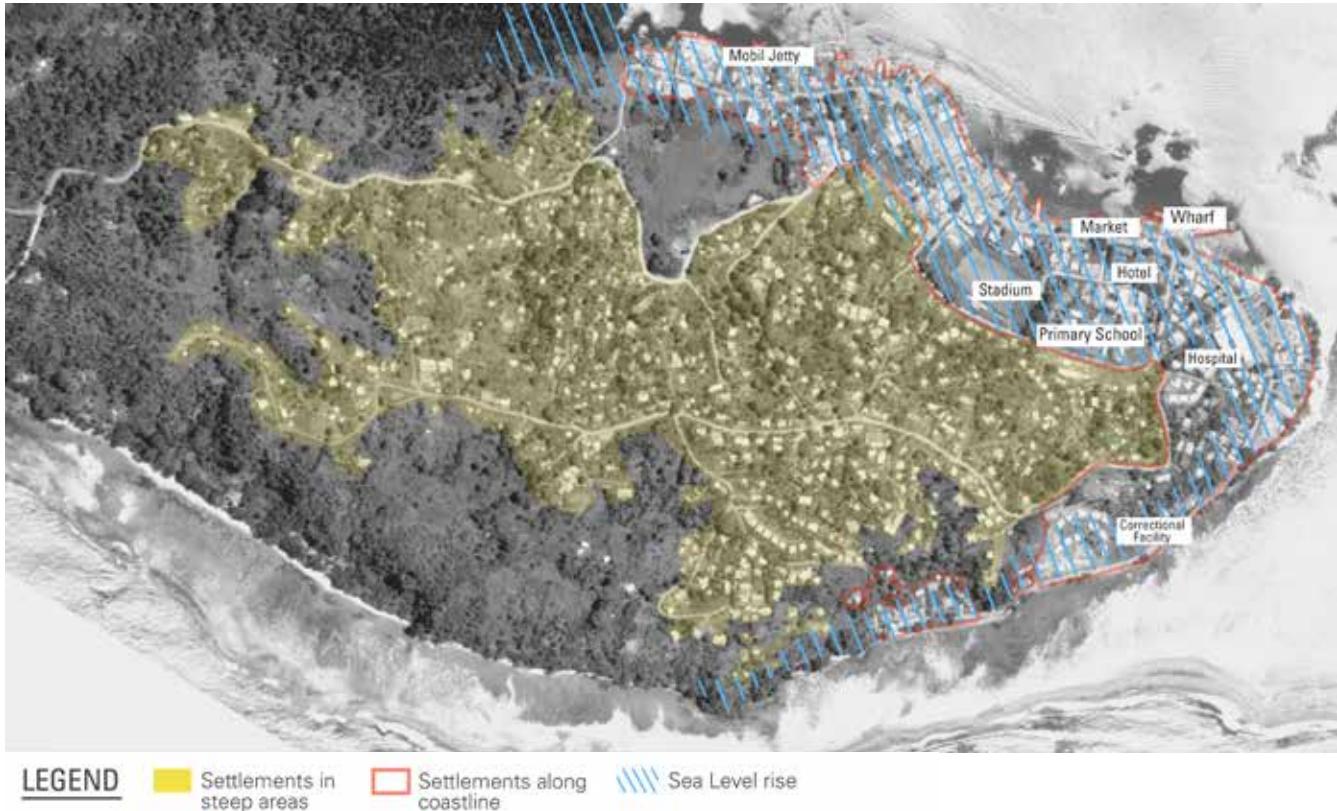
The assessment found the following groups are the most vulnerable to climate change because of their exposure to climate hazards, and the complex interaction that they have with multiple layers of physical and social vulnerabilities.

- THOSE LIVING IN NEW SETTLEMENTS IN THE EXPANDING PERIPHERY. THESE PEOPLE'S WATER SOURCES ARE THREATENED, BUT ALSO UNDERMINE THE TOWNSHIP'S FUTURE WATER SUPPLY.
- GIZO'S RESIDENTS TOO, SINCE COMMON RESOURCES ARE BEING DIMINISHED – THE ISSUE ENDS UP HAVING BIGGER IMPACT.
- PEOPLE FROM SURROUNDING COMMUNITIES AND ISLANDS WHO ARE IMPACTED BY CLIMATE CHANGE DURING TIMES OF STRESS.
- WOMEN AND CHILDREN ARE THE WORST TO SUFFER, AS WELL AS ELDERLY AND DISABLED PEOPLE. THEY WALK LONG DISTANCES IN SEARCH OF WATER FOR COOKING AND WASHING AND MAY BE SUBJECT TO LONG DELAYS WAITING IN QUEUES OVERNIGHT, OR FOR DAYS, FOR WATER. THIS NOT ONLY JEOPARDIZES THEIR MENTAL AND PHYSICAL WELL-BEING BUT CAN ALSO CAUSE RISK TO THEIR SAFETY.

### **Vulnerable Places**

Vulnerability is not distributed evenly, it varies from one place to another, with some areas particularly dangerous, or prone to harm. Using our analysis we can examine the spatial distribution of vulnerability and identify 'hotspots' which are particularly susceptible to climate impacts. This map can be used to give emphasis to some areas over others and inform the design of actions and strategies to reduce climate change vulnerability.

- THOSE LIVING ON STEEP HILLSIDES ARE VULNERABLE TO LANDSLIDES DURING TIMES OF HEAVY RAINFALL.
- RESIDENTS IN THE CENTER OF GIZO WHERE THE SYSTEM NOT WORKING.
- POOR AREAS AND SLUMS WHICH SUFFER FROM INADEQUATE WATER SUPPLY INFRASTRUCTURE.
- COASTAL COMMUNITIES AND THOSE ON SURROUNDING ISLANDS.



**LEGEND**

- █ Settlements in steep areas
- █ Settlements along coastline
- ▨ Sea Level rise

**Figure 22:** Gizo's vulnerable areas - settlements in hillsides area, settlements along the coastline and slums area which suffer from inadequate water supply infrastructure.

## Vulnerable Systems

The combination of impacts from both climate hazards and development trends on a township or village has the potential to negatively impact not only people and communities, but entire systems too. Systems can be man-made infrastructure or services, that support the basic functioning of the township or village, such as the water supply infrastructure, or trash collection system. But they can also be natural, ecosystems that provide services such as watersheds supplying water or mangrove areas protecting the coastline from coastal erosion. Systems are vulnerable to climate hazards, but some are particularly critical for the safe functioning of the settlement. The most important in this case are:

- MANAGEMENT OF WATER CATCHMENT AREAS
- PLANNING AND ZONING FOR HOUSING SETTLEMENTS AND GROWTH.
- WATER PAYMENT SYSTEM

## **8.3. FUTURE VULNERABILITY SCENARIOS**

Two contrasting future scenarios for Gizo are presented, looking forward twenty years from now.

The first scenario is the 'Vulnerable Township Future'. In this scenario, despite the increase of exposure due to climate change, actions to reduce sensitivities and enhance adaptive capacities are not taken. As a result, current problems get worse, and the impacts of climate change cause further environmental and social challenges for the community.

The second scenario is called 'Resilient Township Future'. In this scenario, although exposure may increase due to climate change, various measures are taken to reduce sensitivities and enhance adaptive capacities. Community and government have decided to prioritize adaptation measures, built capacity and planned ahead in order to set in place the necessary regulations, behavior and infrastructure to make their community more resilient to climate change.

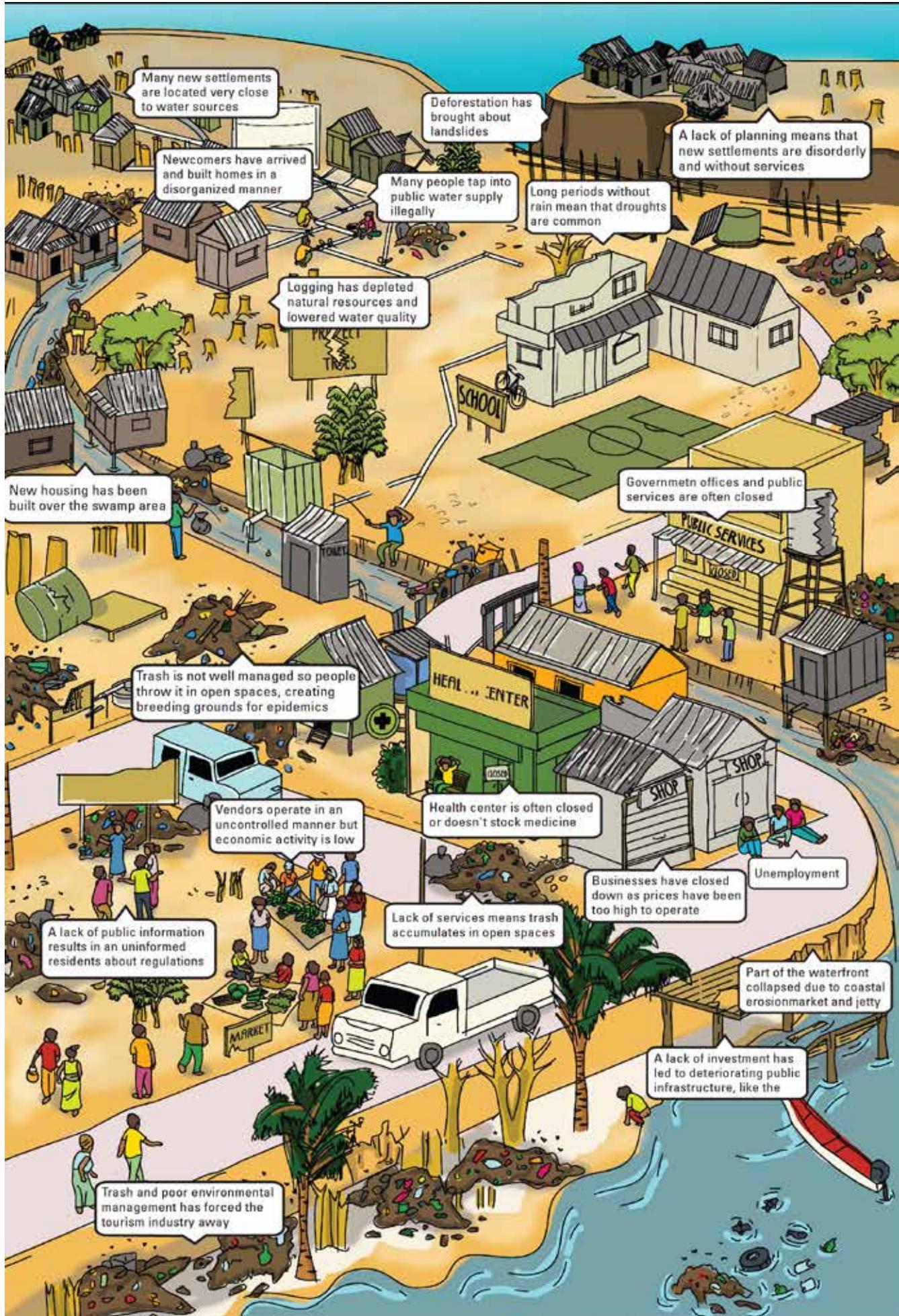
### **VULNERABLE GIZO 2036**

Over the past twenty years Gizo has experienced a number of severe climatic events including a droughts and periods of very heavy rainfall that caused a number of landslides in the hills surrounding the city. In 2024 there was a tropical cyclone that hit some of the rural communities in the Western Province, this caused many families to flee their villages to Gizo seeking refuge. Many of them now live in the largely deforested hillsides or in the mangrove area that has been filled in. During the hot season the heat has become extremely hot, and this has had an impact on agriculture, often there are few crops produced due to the extended periods of heat and drought.

In 2036 Gizo has become a bustling city, growing to over 15,000 inhabitants; it's a city with many businesses, flights from Honiara, and traffic congestion, it feels very crowded. But there was hardly any planning for such rapid growth, so the new migrants just found housing illegally, squatting on land which at first was remote, but these communities have grown significantly. There have been problems with these occupations, between newcomers and private land owners and also with other neighboring communities. These problems have resulted in social disputes that sometimes became violent.

Despite the arrival of newcomers there was no change made to the township's water supply system, which doesn't function anymore, or other public services. The government was unable to resolve disputes over the tapping of supply lines, or to attract investment in a new system. As a result people have mostly resolved to their own water collection, such as rainwater harvesting; or illegally connected to springs. Many of the homes in hillsides don't have adequate sanitation facilities, so they pollute water resources for those downstream. The effect of inadequate water supply started to upset local residents and businesses in 2024, prompting many to leave the city citing it was not a good place to live or invest. This has had an impact on unemployment.

The lack of sufficient water and sanitation had an impact on other sectors too. With tourism investment greatly reduced there has been less money spent on other infrastructure investments like the public market. It has become very unhygienic and causes major traffic jams. Erosion of the coastline near the market further reduced its capacity because a section of the waterfront collapsed. But sadly such problems have been met with apathy, local government concedes that it doesn't have the power or resources to make changes, so they can do very little.



## **RESILIENT GIZO 2036**

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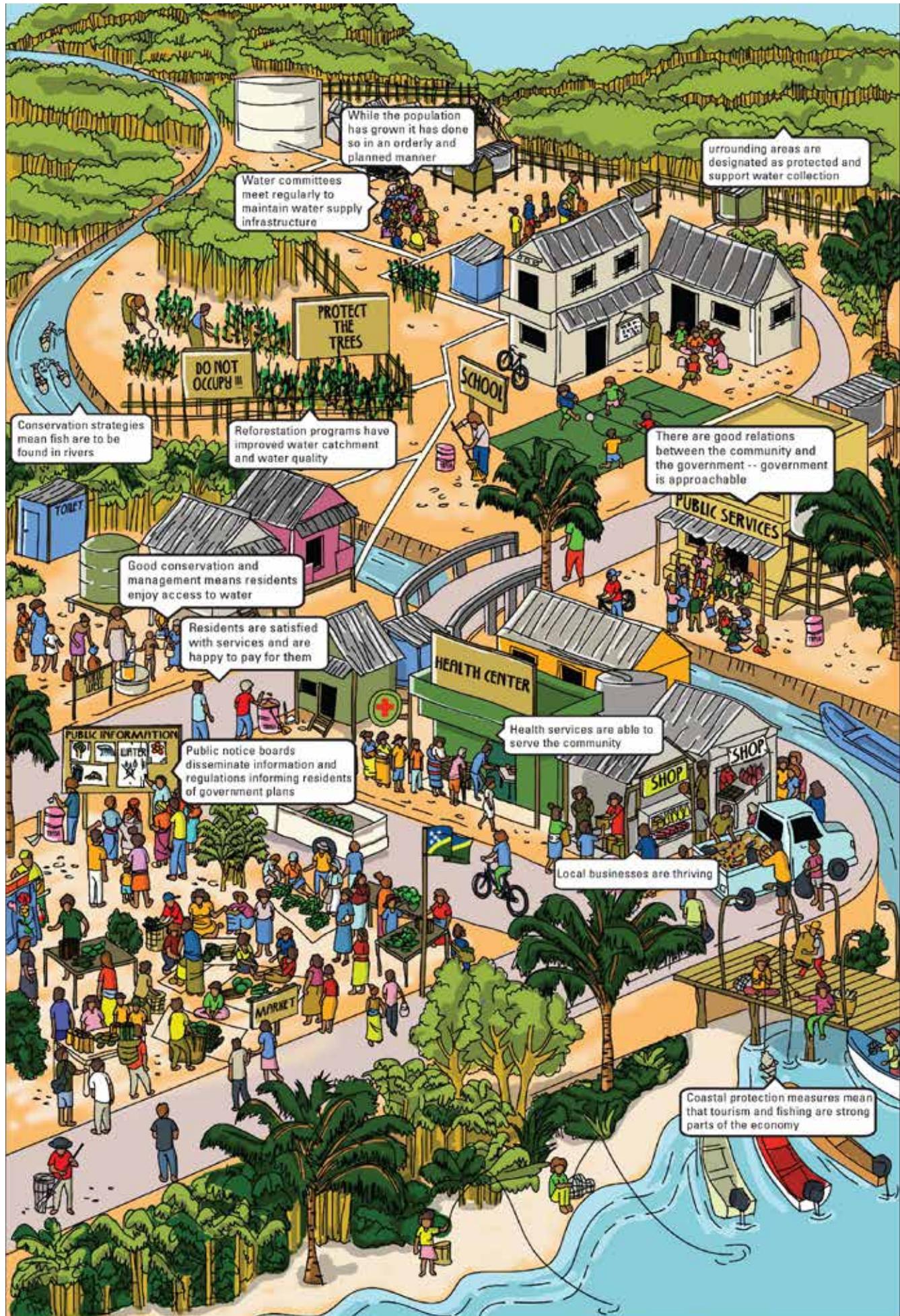
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Over the past twenty years Gizo has experienced a number of severe climatic events including a droughts and periods of very heavy rainfall that caused a number of landslides in the hills surrounding the city. In 2024 there was a tropical cyclone that hit some of the rural communities in the Western Province, this caused many families to flee their villages to Gizo seeking refuge. During the hot season the heat has become extremely hot, and there is also a big difference in the sea-level which has risen and threatens to flood some parts of the city's waterfront area.

Between 2016 and 2036 various Provincial and local administrations prioritized planning a vision for Gizo that would take into account its potential for growth, and the onset of climate change. While it has grown significantly to a population of 12,000 inhabitants it has done so through making land available to newcomers so that it is affordable and connected to infrastructure and services. This has meant that over the years conditions in the city have gotten steadily better, and service quality has risen. Now everyone has access to clean water and electricity.

One of the most significant improvements since 2016 has been the openness and good relationship between the community and the government. The government started to make information publically accessible, first on noticeboards, but also on the radio, through community meetings and posters, so that all residents were aware of government plans, regulations and announcements. Residents find that government approachable and accountable, and ready to engage with community concerns. As a result there is a lot of trust and communication and residents are happy to pay for services such as water.

One of the issues of the past was deforestation of the hillside, but now the hillside and watershed are almost entirely regrown. The public ordinances that protect development there ensured that there was replanting of trees and illegal squatters were resettled in other areas. This had the impact of improving water collection and so the eight springs were able to become eight reservoirs, which also provide energy through mini-hydro dams. The effect of a good water supply and lower and more reliable energy costs has meant better business. There are now more businesses that are investing in the city, including hotels, entertainment, and restaurants, and more jobs too.



## SUMMARY OF VULNERABILITY

Gizo is vulnerable to climate change not only due to its exposure to a variety of climate hazards, but also due to a number of man-made factors that make it sensitive.

- **MANAGING GROWTH AND CONTROLLING HUMAN SETTLEMENTS:** AS A FAST-GROWING PROVINCIAL CAPITAL GIZO ATTRACTS NEWCOMERS; CURRENT WATER SUPPLY INFRASTRUCTURE IS ALREADY OVERSTRETCHED SO MANAGING GROWTH IS ONE OF GIZO'S BIGGEST CHALLENGES. SQUATTING BY MIGRANT ARRIVING IN GIZO WHO SETTLE IN CONSERVATION AREAS OF THE WATERSHED IS REDUCING WATER ABSORPTION CAPACITY.
- **ILLEGAL CONNECTIONS:** MANY HOUSEHOLDS ARE TAPPING INTO WATER SUPPLY PIPES AND DIMINISH WATER SUPPLY FOR THOSE IN THE TOWNSHIP CENTER, AS WELL AS VANDALIZING GOVERNMENT PROPERTY.
- **INSUFFICIENT WATER FOR RESIDENTS:** THE RESULT OF DIMINISHED WATER CATCHMENT CAPACITY AND ILLEGAL TAPPING IS THAT THERE IS INSUFFICIENT WATER TO THOSE CONNECTED TO GOVERNMENT SUPPLY LINES.
- **BROKEN PARTS:** ANOTHER PROBLEM IS BROKEN PARTS. WITH LITTLE FUNDING AND CAPACITY AVAILABLE BROKEN PARTS HAVE COMPROMISED THE SYSTEM WHICH HASN'T BEEN ADEQUATELY REPAIRED.
- **LOW AWARENESS ABOUT WATER MANAGEMENT:** THERE IS LITTLE AWARENESS ABOUT GOVERNMENT REGULATIONS OR SUSTAINABLE WATER PRACTICES, AND THIS PUTS HOUSEHOLD SUPPLY AT THREAT DURING TIMES OF WATER SCARCITY
- **UNCLEAR GOVERNANCE:** THERE IS A LACK OF CLARITY ABOUT RESPONSIBILITIES, SO CONFUSION REIGNS AND AFFECTS THE CAPACITY FOR AN INSTITUTIONAL RESPONSE.

# 9. PROBLEM IDENTIFICATION

In order to design strategies that enhance climate change adaptation it is important to dissect and analyze the issues that contribute to vulnerability. To help us do so we have created a few problem statements that focus our attention on the key issues that each site faces. The problem statement will be examined using the 'Problem Tree' method (introduced during the Adaptation Planning Phase), which allows workshop participants to discuss and identify the root causes of each problem, as well as their primary and secondary impacts.

## **1. GIZO'S WATER SYSTEM IS UNABLE TO COPE WITH RISING DEMAND SO PEOPLE ARE NOT GETTING ENOUGH WATER**

The institutional structure and capacity of Gizo's water supply is not able to manage the rising demand and operational needs of the expanding township. Decentralization has allocated responsibilities to the local level, but there are insufficient resources, technical expertise, and investments, to ensure that the system can function. At the moment there are few regulations in place, and those that exist are not adequately disseminated; there is little enforcement either. As a result communities and households have improvised their own water supply systems, often to the detriment to others. With demographic and economic growth, Gizo needs to improve and expand the system, requiring large investments and a user payment system. Due to its dysfunction in recent years, people are unhappy about paying for this, so government and private sector investment is needed. If the water supply system is not improved Gizo will continue to be vulnerable and many people will not be able to access enough water to service their needs.

## **2. THE WATER SUPPLY INFRASTRUCTURE IS BADLY DAMAGED, LEADING TO SYSTEM FAILURE**

Gizo's water supply infrastructure, which includes water mains supply pipes traveling long distances to water sources, is in poor condition. There are pipes that are broken, in some sections there is illegal tapping, even vandalism, and conflicts over public use of private lands without easements. Other problems include households living in protected areas reserved for water capture near water sources; many are climate refugee and migrant families, seeking access to employment and services in the township. In addition the Provincial Government has sold land where water sources are located to private owners. There is a general lack of enforcement of regulations that seek to protect these areas and preserve water supply infrastructure. As a result the flow of water has been greatly impaired, placing households depending on public water supply in a position of vulnerability.

## **3. THERE IS LOW AWARENESS ABOUT WATER CONSERVATION METHODS**

Overall there is low awareness about what measures are necessary to ensure sustainable and lasting water supply in Gizo. Women in particular have little information about water conservation measures and the implications of changing climatic conditions, despite primarily being the ones responsible for managing it at the household level, both in the township and in surrounding settlements. Outreach and public awareness campaigns are needed, in all of Gizo's zones, to ensure people have access to information and know what they should do to conserve water properly. Civil society organizations, such as the climate change and water committee, can serve as a valuable link, but are just starting and require organizational support and capacity. The lack of awareness leads to vulnerability because people do not know how to best manage water in times of stress.

# 10. RECOMMENDATIONS

The objective of the CCVA is to better understand the nature of climate change in XX and how it will affect the community. The following recommendations are aimed at providing guidance to provincial and local government, civil society organizations and NGOs, and local community groups and residents, so they can better prepare for the challenges of responding to climate change hazards.

While this is not an exhaustive list the recommendations offer some specific actions and strategies that can be adopted in the Adaptation Plan, and implemented to help reduce vulnerability to climate change:

## **1. REGULATIONS ARE NEEDED TO BETTER ADMINISTER WATER SUPPLY**

One of the most urgent needs is the establishment of a clear set of regulations in Gizo governing the administration of the water supply. This includes everything from protecting existing water sources, the protection of watersheds or new water sources, a set of housing guidelines to ensure that water sources are protected, and the involvement of local authorities and the police to play a more active role in the enforcement of local regulations. Such regulations, when clearly defined and carefully enforced, can help restore confidence from investors, and also provide guidance to residents who are not used to following regulations regarding water use.

## **2. REPAIRS AND MONITORING OF THE EXISTING SYSTEM**

Gizo's existing water supply infrastructure and system is far more developed than most other townships in the Solomons, but urgent action is needed to respond to damaged or faulty parts. Some of the recommended actions are: i) government should acquire land along pipelines, or watershed areas that need conservation, to better protect pipes and ensure recharge; ii) replace vandalized pipes to expand capacity to the existing network; iii) provide clear signage and fencing of areas where tapping of water is prohibited; and iv) rehabilitate the reservoir and develop a protection zone around the reservoir to improve the resilience of the system, by providing additional storage and capacity.

## **3. THE PROVINCIAL AND NATIONAL GOVERNMENTS REQUIRE CLEARLY ESTABLISHED ROLES AND LEADERSHIP**

Another important issue is the need for clear designation of the roles of – national government, Provincial government, the Gizo water committee – to ensure that there is accountability and clarity over who should be doing what. While set of clear water administration regulations for residents is important, the government requires clear definition of its responsibilities too, as there is a lot of confusion as to who should be in charge of what. For example: Provincial government can emit new rules, regulations and ordinances governing proper water use. The National government can provide incentives to encourage private sector investment in Gizo's water supply system; and the local water committee can train residents and community organizations how to manage household supply and implement conservation strategies during times of stress. The institutions charged with managing Gizo's water supply (at national, Provincial, and local levels) should be endowed with sufficient financial and human resources to achieve their mandate.

## **4. WOMEN SHOULD BE ACTIVELY INVOLVED IN WATER GOVERNANCE AT THE LOCAL LEVEL**

The water committees are an essential body to the dissemination of information about water conservation, the successful sharing of information (between local communities and the government), and to ensure adherence to regulations. Women should be included in water committees, and be actively involved in campaigns to raise awareness. Such campaigns should also include messaging focused at women, youth, the disabled, and older people, and provide ways for their concerns to be taken into account.

## **5. EFFORTS TO RAISE PUBLIC AWARENESS**

Collective, coordinated, and concerted efforts are required to promote a better sense of ownership of water supply infrastructure, for better maintenance, and for more efficient use of water. Such a strategy could involve local community organizations such as churches, women's groups, youth groups, and local media outlets, to raise general awareness and improve attitudes about water use throughout the population.

## **6. NEW CHANNELS TO DISSEMINATE AND RECEIVE INFORMATION**

In order to raise public awareness it is essential for residents to receive more information about water, seek accountability for its effective management, and encourage public engagement regarding how it is administered. To support this more sharing of information is needed to make important water conservation information available; for example using information boards and outreach. Local community organizations should be engaged (as previous point suggests) , to disseminate information at the community-level; landowners and tribes should be involved in planning processes, and in efforts to disseminate regulations. And consultation and coordination is needed between men and women's groups to ensure more equal and active participation in decision-making regarding water resources. Such efforts require new and far-reaching means of sharing information.

# 11. NEXT STEPS

The CCVA has two principal objectives, one is to raise awareness amongst residents and government by improving understanding about the nature of climate change and its will impact upon XX; the second is to serve as a planning tool that can assist community members and the government in developing the Water Sector Climate Change Adaptation Plan (WS-CCA).

The CCVA serves as a point of departure for the next steps of the climate change adaptation process, and a reference that identifies the most urgent issues, places and priorities that should be considered. These priorities will inform and define strategic thinking about how to best reduce vulnerability.

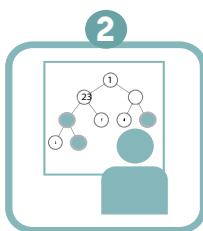
To use the CCVA effectively we recommend following the sequence of steps that will lead the community to creating their own WS-CCA. The process is designed to cover two workshops, during an estimated period of one month; it is important that a diverse range of community members are involved, including women, elderly, and youth community members. The steps are described in detail below:

## WORKSHOP 1



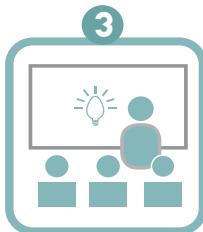
### REVIEW VULNERABILITY ASSESSMENT

Review the CCVA document to remind workshop participants what has been learned about vulnerability (the priority people, places and systems), as well as refresh people's memory about potential solutions and recommendations.



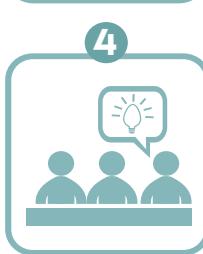
### ELABORATE PROBLEM TREE EXERCISE

Drawing from lessons identified by the CCVA, the key vulnerability issues will be dissected and analyzed by stakeholders using the 'Problem Tree' approach. This helps to identify root causes of vulnerability and identify strategies and solutions.



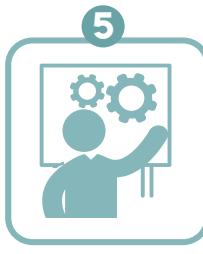
### DEVELOP A VISION AND OBJECTIVES

Planning for a resilient future requires envisioning what that future will be and what steps are needed to get there. The visioning exercise helps give direction to planning efforts and identify specific objectives that will guide the adaptation planning process.



### CONSIDER STRATEGIC THINKING

Workshop participants will be reminded of the importance of '*thinking strategically*' so that project proposals balance the need for regulations, community organization, effective management, and infrastructure investments. A presentation will be made that emphasizes the staging of a prioritized set of actions to ensure effective implementation.



### DEVELOP PROPOSED OPTIONS

Participants will identify a set of proposed projects that enhance climate change resilience and reduce vulnerability in their respective site. Proposal development requires evaluating impact, feasibility, sustainability, and management requirements.

## WORKSHOP 2



### SELECT PROJECTS

Project selection will be conducted by a selected panel from each community, using a set of established criteria given by the SIWSAP programme, criteria cover social, technical, environmental, and financial considerations. Selected projects form the basis of the community's WS-CCA plan.



### FINALIZE ADAPTATION PLANNING TIMELINE

Once projects have been selected they are placed in a sequence in a timeline which represents the strategic implementation plan or WS-CCA plan for the community.

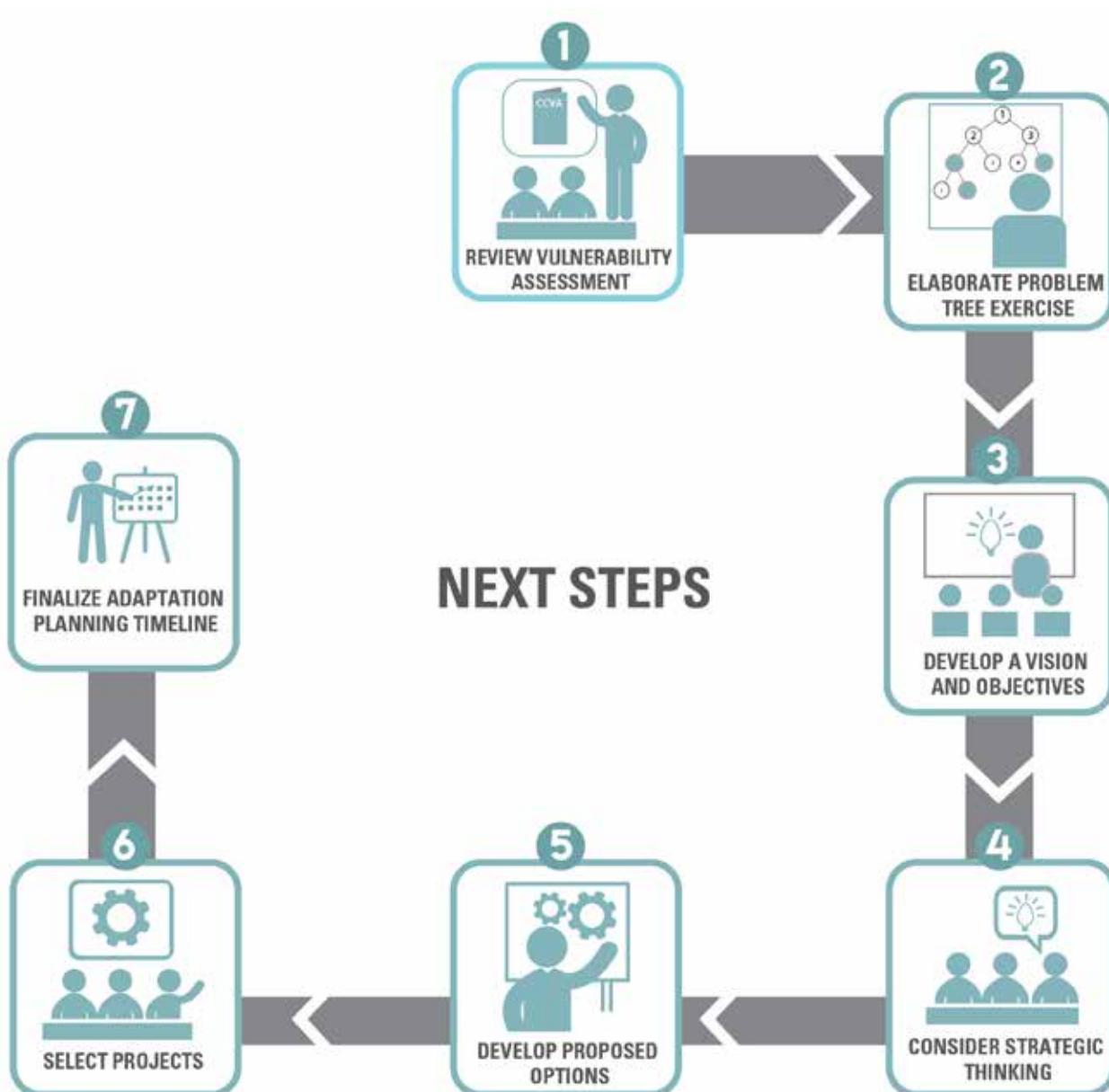


Figure 23: Next step

# APPENDIX

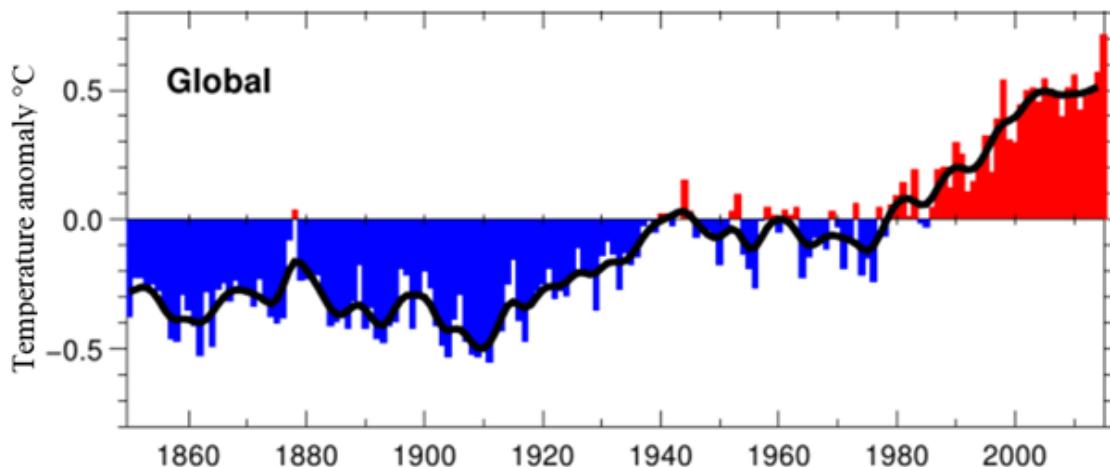
## A1 – WHAT IS CLIMATE CHANGE?

The United Nations Framework Convention on Climate Change (UNFCCC) defines “climate change” as:

**“A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”.**

Thus, the UNFCCC thus makes a distinction between “climate change” attributable to human activities altering the atmospheric composition, and “climate variability” attributable to natural causes.

The Earth’s climate is changing because people are adding heat-trapping “greenhouse” gases to the atmosphere, mainly by burning fossil fuels (such as coal and oil, which release carbon-dioxide when burned). The primary effect on the climate of increasing atmospheric greenhouse gas concentrations is the temperature of our air and oceans is increasing (see Figure A1.1, which shows that 2015 was the warmest year for at least the last 150 years).

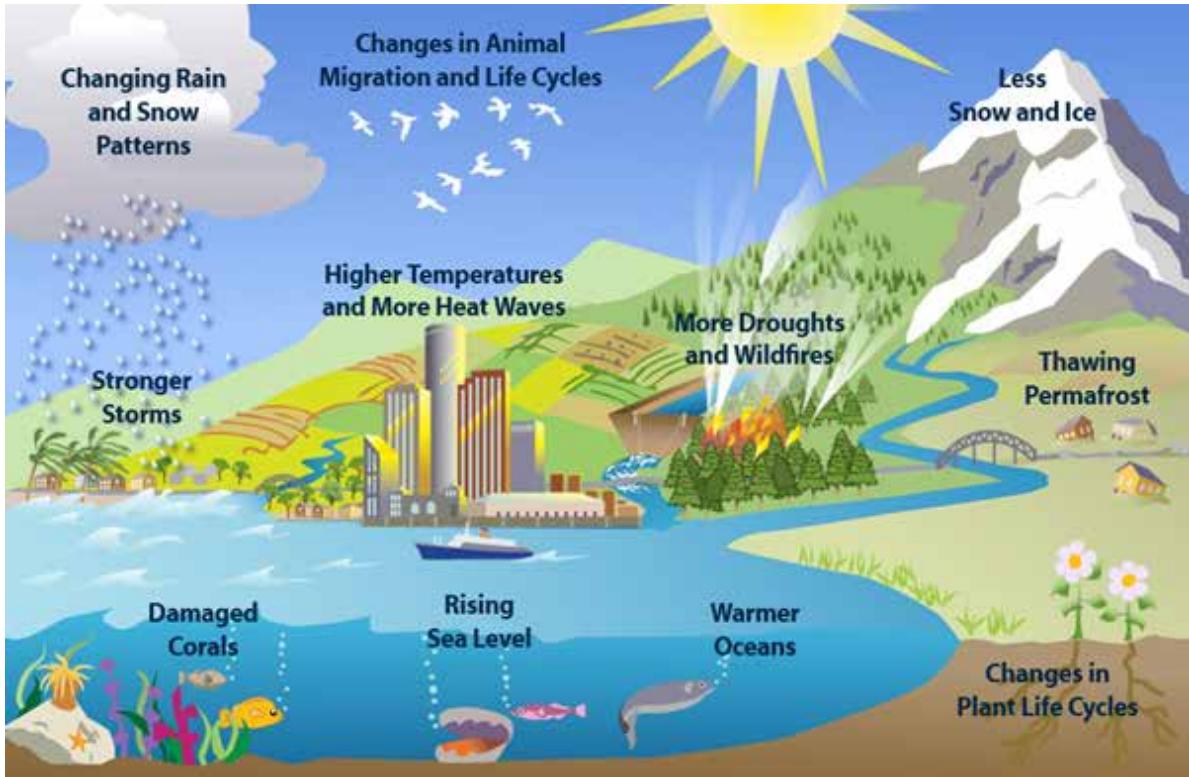


**Figure A1.1:** Global average temperature (combined sea surface and air temperature) anomaly, from the period 1961-90, for the period 1850-2015 (last year is only up to October. From <http://www.cru.uea.ac.uk/cru/data/temperature/>).

Higher temperatures are causing other climate-related changes around the world, such as melting glaciers and stronger storms. These changes are happening because the Earth’s air, water (in all its phases), and land are all interconnected in what is called the “Earth System”.

The Earth’s climate has changed before, but this time is different. People are causing these changes, which are happening faster than any climate changes that modern society has ever seen before.

Climate change has already led to many biophysical impacts around the world, and as the planet continues to warm scientists expect that these impacts will become more frequent and severe. Figure A1.2 shows the kind of impacts that will have serious consequences for our planet’s ecosystems and human societies.



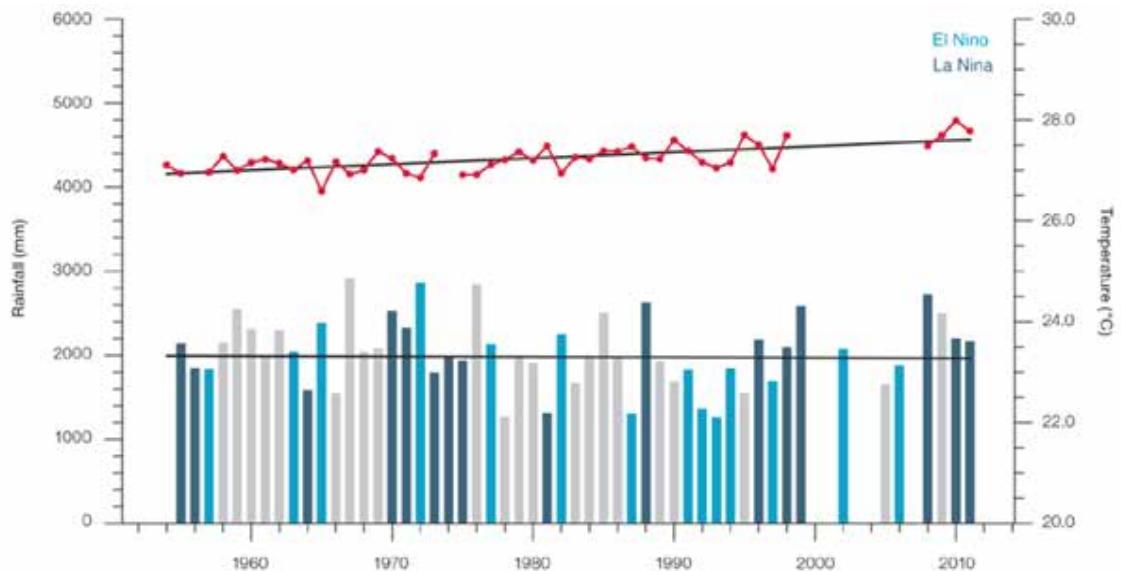
**Figure A1.2:** Multiple effects of a changing climate (from <http://www3.epa.gov/>).

Reducing greenhouse gas emissions is the key to reducing the severity of the impacts of global climate change. A major way these gases get into the atmosphere is when people burn coal, oil, and natural gas for energy. Greater use of renewable energy resources (including geothermal, sunshine, wind, and flowing water), and more efficient transport systems (particularly public transport) will make a major difference to the climate change problem.

## A2 – HAS THE CLIMATE OF THE SOLOMON ISLAND ALREADY BEEN CHANGING

The climate of the Solomon Islands has already experienced some changes over the last few decades. For example, annual maximum and minimum temperatures have increased in Honiara since 1951 by around 1.0 °C (Figure A2.1), and at both Honiara and Munda there have been significant increases in the annual number of warm nights and decreases in cool nights. In addition, the sea-level rise near Solomon Islands (measured by satellite altimeters since 1993) is around 8 mm per year, although some of this very high rise is likely attributable to natural variability. Also, ocean acidification has been slowly increasing in the Solomon Islands' waters over the last several decades.

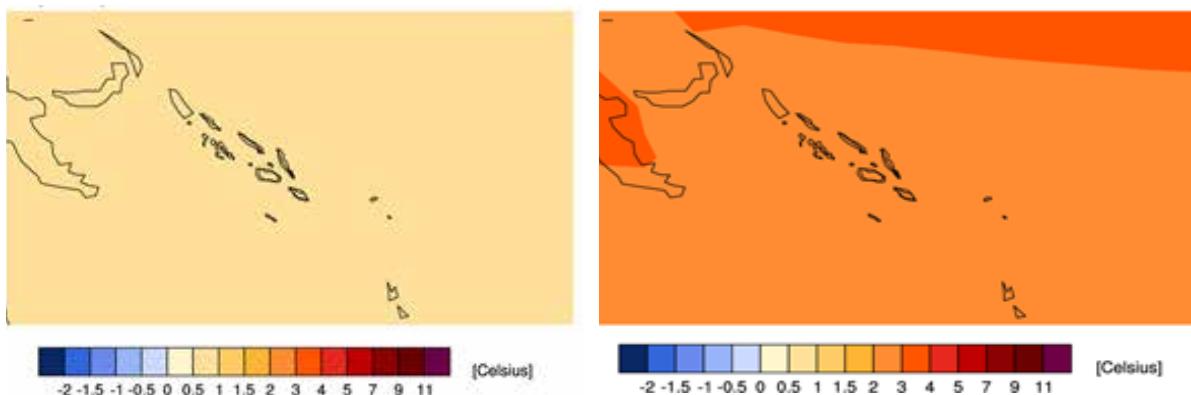
But some aspects of the climate of the Solomon Islands are not changing. Data for Honiara since 1950 show no clear trends in annual or seasonal rainfall (Figure A2.1). Over this period, there has been substantial variation in rainfall from year to year, however, mostly related to the El Niño Southern Oscillation (ENSO) phenomenon (El Niño generally causes below normal rainfall in the Solomon Islands; while La Niña has the opposite effect).



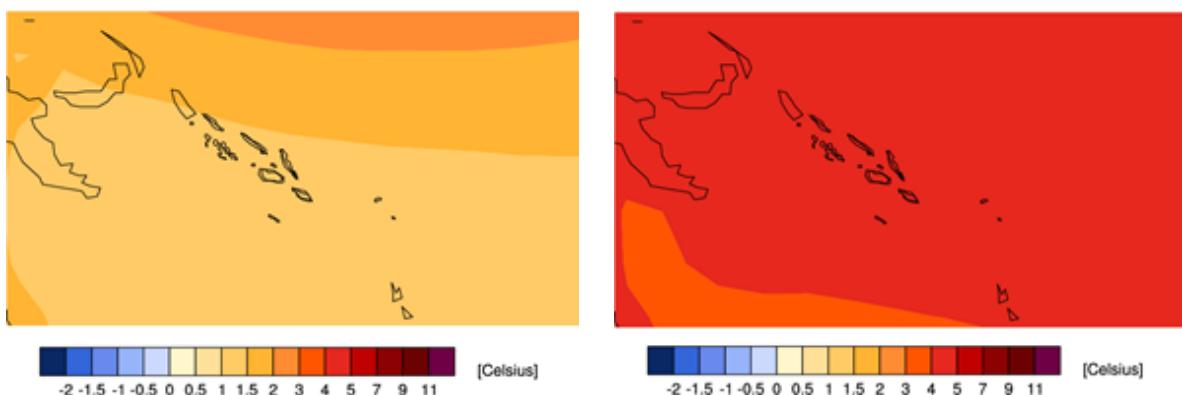
**Figure A2.1:** Observed time series of annual average values of mean air temperature (red dots and line) and total rainfall (bars) at Honiara. Light blue, dark blue and grey bars denote El Niño, La Niña and neutral years respectively. Solid black trend lines indicate a least squares fit (from <http://www.pacificclimatechangescience.org/>).

## A3 – CLIMATE CHANGE MAPS AND DATA

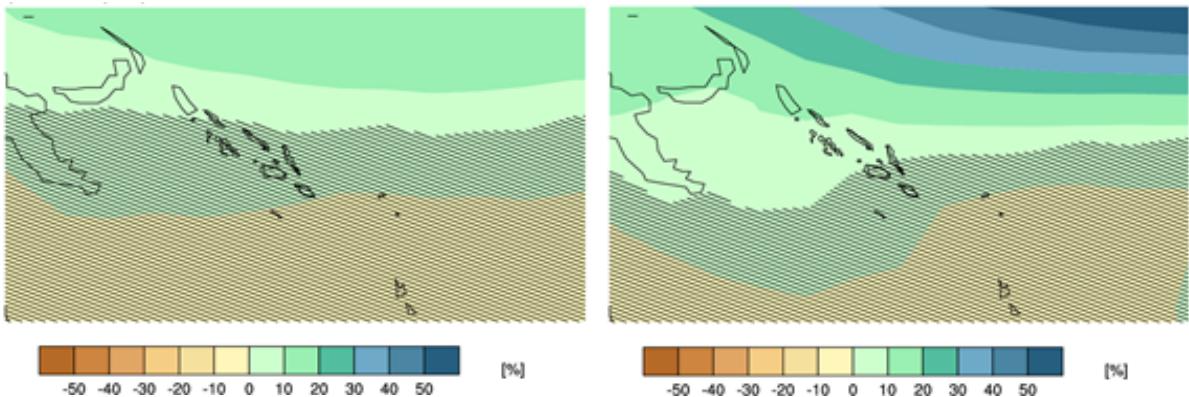
The following maps were generated using the Royal Netherlands Meteorological Institute (KNMI) Climate Explorer tool (<http://climexp.knmi.nl/>). All data for these maps are the model-average from the Coupled Model Inter-comparison Project (CMIP5) data archive, and are the same data used to derive the Intergovernmental Panel on Climate Change (IPCC) Climate Change Atlas (<http://www.ipcc.ch/report/ar5/wg1/>).



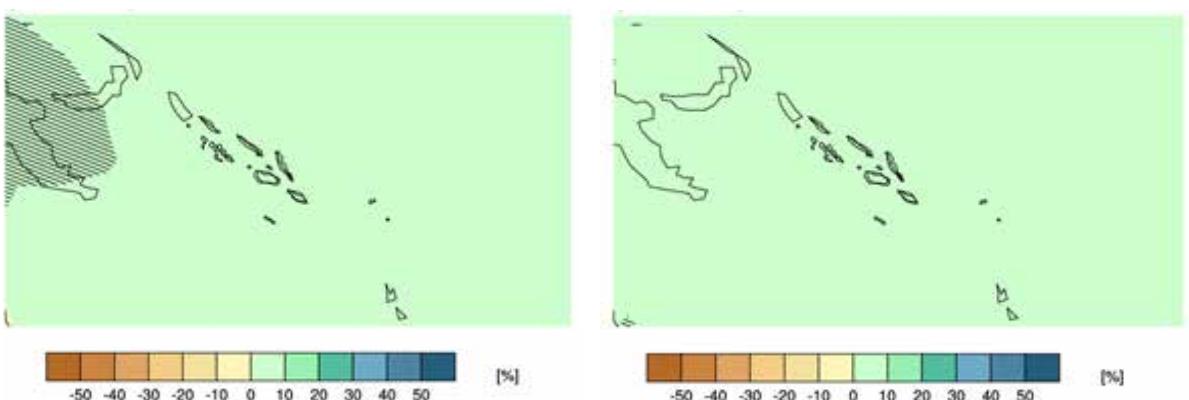
**Figure A3.1:** Projected change in the mean annual temperature between 1986-2005 and 2081-2100, for RCP2.6 (left) and RCP8.5 (right) (from <http://climexp.knmi.nl/>).



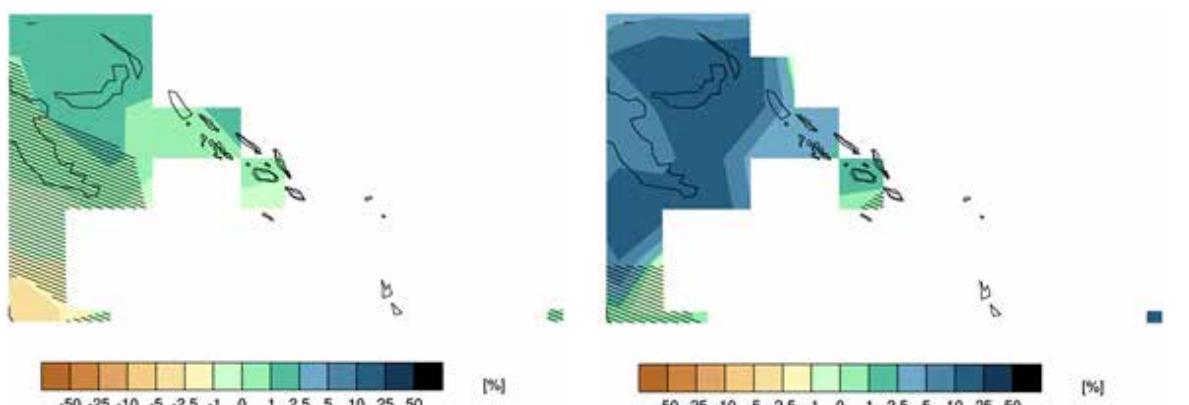
**Figure A3.2:** Projected change in the 95th percentile mean annual maximum daily temperature between 1986-2005 and 2081-2100, for RCP2.6 (left) and RCP8.5 (right) (from <http://climexp.knmi.nl/>).



**Figure A3.3:** Projected percent change in the mean annual precipitation between 1986-2005 and 2081-2100, for RCP2.6 (left) and RCP8.5 (right). The hatching represents areas where the signal is smaller than one standard deviation of natural variability (from <http://climexp.knmi.nl/>).



**Figure A3.4:** Projected percent change in the mean annual evaporation (evaporation, transpiration and sublimation) layer between 1986-2005 and 2081-2100, for RCP2.6 (left) and RCP8.5 (right). The hatching represents areas where the signal is smaller than one standard deviation of natural variability (from <http://climexp.knmi.nl/>).

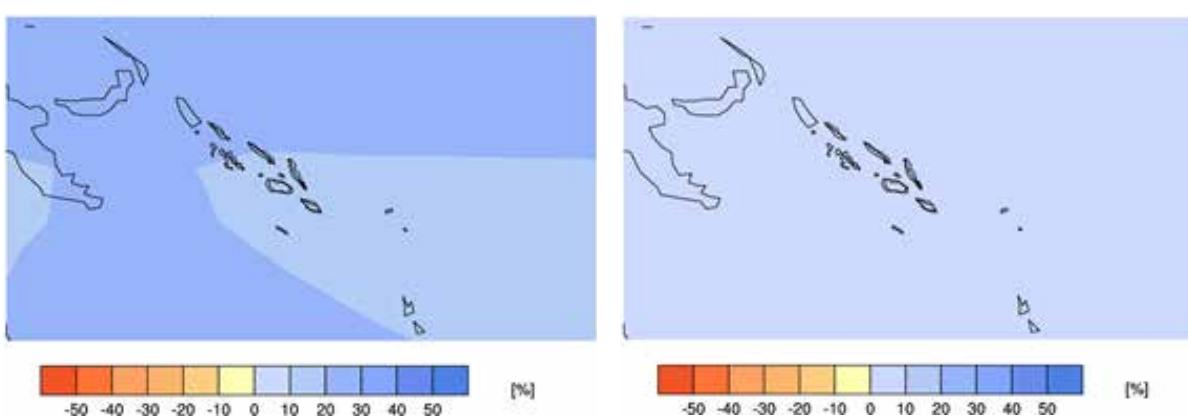


**Figure A3.5:** Projected percent change in the mean annual moisture content in the soil layer between 1986-2005 and 2081-2100, for RCP2.6 (left) and RCP8.5 (right). The hatching represents areas where the signal is smaller than one standard deviation of natural variability (from <http://climexp.knmi.nl/>).

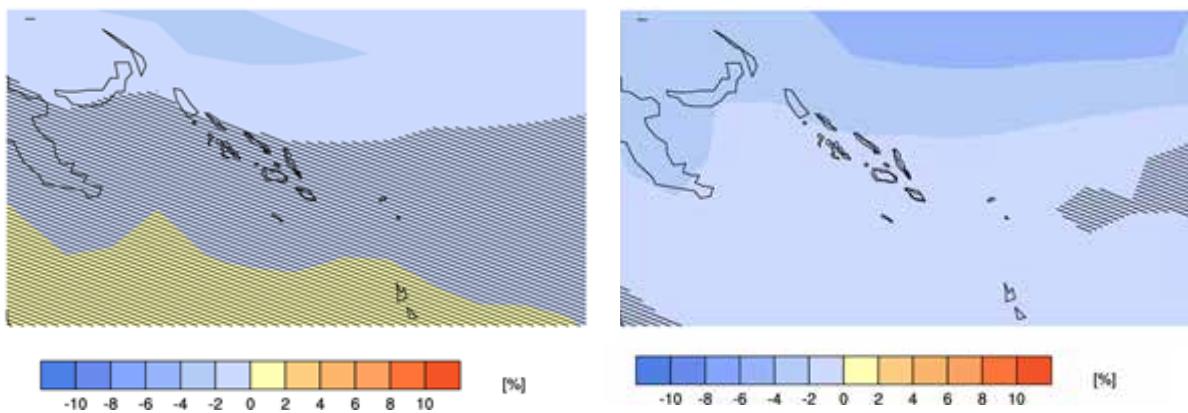
From Figures A3.1 and A3.2, it can be seen that the increase in the average daytime maximum temperature for the warmest five percent of years is projected to be around twice as much as the increase in the mean temperature, meaning the change in very warm years is likely to be disproportionately greater than the change in the average years.

Also, Figure A3.5 shows a general (but small) increase in mean annual soil moisture content over the country, in response to a slightly greater percent increase in annual rainfall (Figure A3.3) compared to evaporation (Figure A3.4). This is consistent with the conclusion in Section 1.2 that drought frequency is projected to slightly decrease. It should be noted however, that the projected change in rainfall for the Solomon Islands is mostly within one standard deviation of natural variability, indicating that confidence in the climate change “signal” is not high.

From Figures A3.6 and A3.7 it can also be seen that in general, specific humidity is projected to increase (i.e. a moister atmosphere) and downward solar radiation at the surface is likely to decrease (i.e. cloudier conditions).



**Figure A3.6:** Projected percent change in the mean annual specific humidity between 1986-2005 and 2081-2100, for RCP2.6 (left) and RCP8.5 (right). (from <http://climexp.knmi.nl/>).



**Figure A3.7:** Projected percent change in the mean annual downward solar radiation at the surface between 1986-2005 and 2081-2100, for RCP2.6 (left) and RCP8.5 (right). The hatching represents areas where the signal is smaller than one standard deviation of natural variability (from <http://climexp.knmi.nl/>).

# A4 - CCVA EXPOSURE AND GENDER SURVEY

DATE \_\_\_\_\_ AGE \_\_\_\_\_ GENDER \_\_\_\_\_ SPECIAL NEEDS \_\_\_\_\_ OCCUPATION \_\_\_\_\_ VILLAGE \_\_\_\_\_ VILLAGE ZONE \_\_\_\_\_

## CCVA EXPOSURE AND GENDER SURVEY

Over the next 12-24 months...

### 1. Sea-level rise

How likely is sea-level rise will affect you?

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact would sea-level rise have on you?

Insignificant  Minor  Moderate  Major  Disastrous

### 9. Terrestrial erosion – caused by flooding

How likely is it that you will be affected by terrestrial erosion caused by flooding?

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact would terrestrial erosion, caused by flooding have on you?

Insignificant  Minor  Moderate  Major  Disastrous

### 2. Abrasion – Erosion of the coastline

How likely is abrasion will affect you?

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact would abrasion have on you?

Insignificant  Minor  Moderate  Major  Disastrous

### 10. High temperatures – caused by the sun

How likely is it that you will be affected by high temperatures (e.g. heat of the sun)?

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact will high temperatures, caused by the sun, have on you?

Insignificant  Minor  Moderate  Major  Disastrous

### 3. Salt-water intrusion (Water in wells, agriculture, construction and infrastructure becomes brackish)

How likely is salt-water intrusion will affect you?

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact would salt-water intrusion have on you?

Insignificant  Minor  Moderate  Major  Disastrous

### 11. High temperatures – of the sea

How likely is it that you will be affected by high temperatures of the water (e.g. coral bleaching)?

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact would high sea temperatures have on you?

Insignificant  Minor  Moderate  Major  Disastrous

### 4. High Winds

How likely is high winds will affect you?

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact would high winds have on you?

Insignificant  Minor  Moderate  Major  Disastrous

### 12. In your household who is responsible for fetching freshwater for the family?

Husband  Wife  Son  Daughter  Others

### 5. Tropical Cyclones

How likely is tropical cyclones will affect you?

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact would tropical cyclones have on you?

Insignificant  Minor  Moderate  Major  Disastrous

### 13. Which family member uses water the most?

Husband  Wife  Grandparents  Son   
Daughter  Others

### 6. Water Scarcity

How likely is water scarcity will affect you?

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact would water scarcity have on you?

Insignificant  Minor  Moderate  Major  Disastrous

### 14. In times of water shortage, who takes decisions about managing water?

Husband  Wife  Father / Father in Law  Mother / Mother in Law  Others

### 7. Extreme Rainfall

How likely is extreme rainfall will affect you?

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact would extreme rainfall have on you?

Insignificant  Minor  Moderate  Major  Disastrous

### 15. What strategies do you use to manage water during scarcity?

- Water storage in a tanker
- Avoid misuse/overuse of water
- Participate in community well project
- Buy water
- No idea (my wife / husband does)
- Others

### 8. Too little rain (Drought)

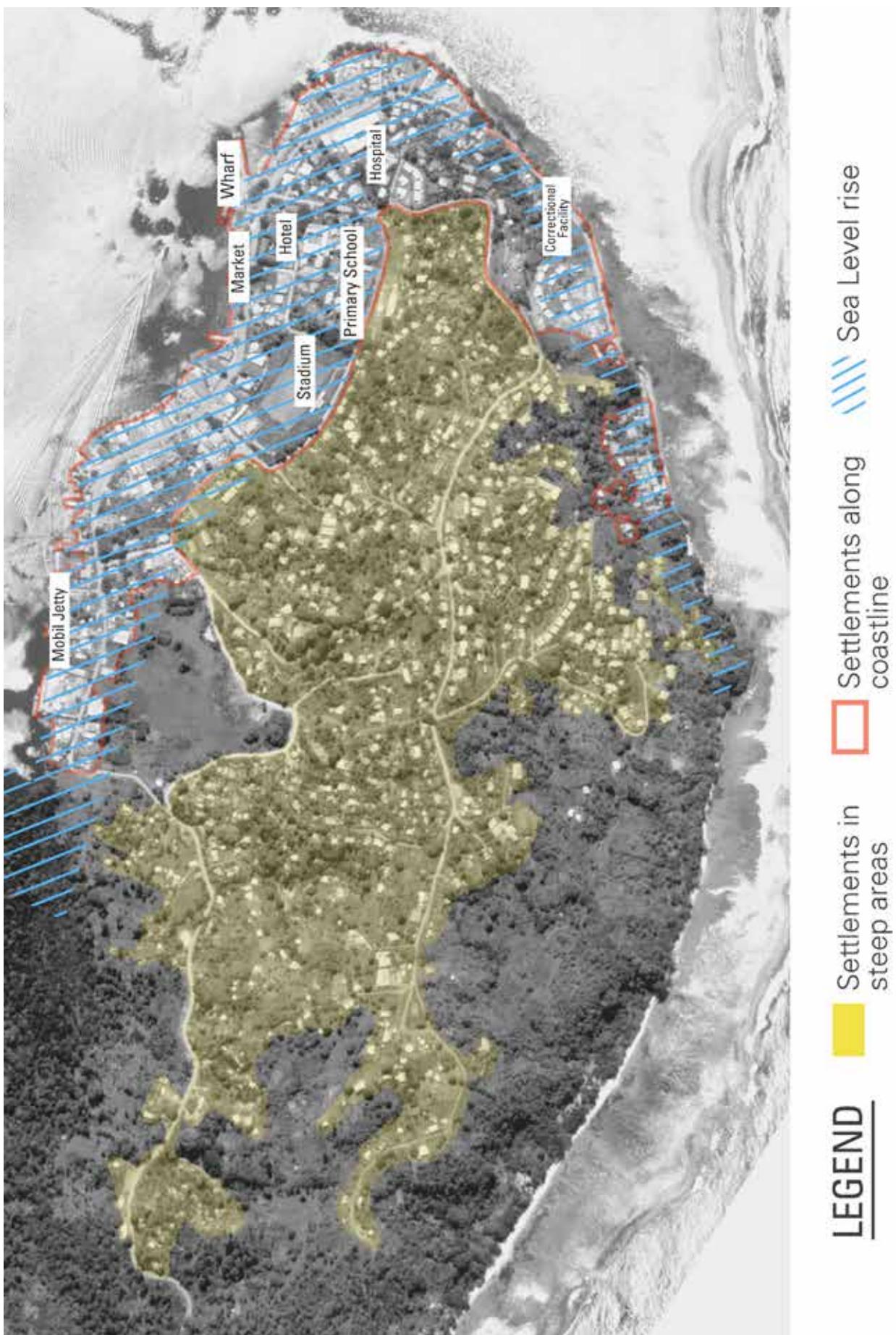
How likely is too little rain (drought) will affect:

Very unlikely  Unlikely  Possible  Likely  Almost certain

How much of an impact would too little rain (drought) have on:

Insignificant  Minor  Moderate  Major  Disastrous

## A5 - GIZO VULNERABILITY MAP



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*Empowered lives.  
Resilient nations.*