



# *SOLOMON ISLANDS*

## *National Adaptation Programmes of Action*



**Ministry of Environment, Conservation and Meteorology  
Honiara,**

***November 2008***

## COVER PAGE

The background picture shows an Island in Rawaki village, Western Province. The Island use to accommodate houses before, the buildable areas within the Island is now covered with salt water. Despite efforts to build the Island with stones, it is still under water.

Inserts are pictures showing village wells which are currently covered by salt water and a newly dug well in land.

The other inserts is a picture showing salt water inundation which actually impacts on coastal plants and coastlines, and a picture showing village initiatives into construction of retaining stone wall to help protect coastlines.

All pictures inserted were collections from NAPA team members and the NAPA Project Management Office.

**Prepared by Fred Talo, NAPA Project Coordinator.**

## FOREWORD



Solomon Islands is not only a Small Island Developing State (SIDS) but also a Least Developing Country (LDC). The country covers a total land area of 28, 785 square kilometres with an estimated population of 508,000 in year, 2007. It does not only have a small population but also is vulnerable to climate change impacts and susceptible to natural disaster occurrences.

It is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and has ratified the Kyoto Protocol. As a party to the convention, the country is required to take full account of its specific needs and capitalize on its special situations to entice donor funding and encourage transfer of appropriate technology.

This NAPA is an attempt by the Solomon Islands Government to assemble the specific needs and special situations of the country.

The NAPA prioritizes and ranks key sectors of the economy that requires urgent and immediate adaptation to solicit funding and enable technology transfer, consistent with Article 4.9 of the UNFCCC.

Nation-wide consultations has shown that 'Managing the Impacts of, and Enhancing Resilience to, Climate Change and Sea-Level Rise, on Agriculture and Food Security, Water Supply and Sanitation, Human Settlements and Human Health' is a top priority among other priorities.

Other important priorities are:

- Climate Change Adaptation on low-lying and artificially built-up islands;
- Waste Management;
- Coastal Protection;
- Fisheries and Marine Resources;
- Infrastructure Development, and;
- Tourism.

As Minister responsible for Climate Change, it is my sincere hope and belief that donors, development partners, international and regional organizations will find this NAPA document useful to facilitate means of implementations; i.e. financing, technology transfer and capacity building to enable Solomon Islanders to adapt to climate change.

Thank you

**Hon Gordon Darcy Lilo, MP**

MINISTER FOR ENVIRONMENT, CONSERVATION & METEOROLOGY

## ACKNOWLEDGEMENTS

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- The Ministry of Agriculture and Livestock
- The Ministry of Forest
- The Ministry of Education and Human Resource Development
- The Ministry of Home Affairs (NDMO)
- The Ministry of Mines, Energy and Rural Electrification
- The Ministry of Health and Medical Services
- The Ministry of Development Planning
- Ministry of Tourism
- Solomon Islands Red Cross Society
- Oxfam Solomon Islands
- National Council of Women
- Development Services Exchange
- United Nations Development Programme
- Commodities Marketing Authority
- Water Resource Division
- Provinces and Local Communities consulted including:
  - Guadalcanal
  - Malaita
  - Renbel
  - Western
  - Makira
  - Isabel
  - Central Islands, and
- All the individuals who have contributed in one way or the other.

Thank you,

Ministry of Environment, Conservation and Meteorology

## EXECUTIVE SUMMARY

As a Least Developed Country (LDC) and Small Island Developing State (SIDS), climate change is the most important environmental and developmental issue for Solomon Islands. Solomon Islands is a low-lying coastal country that shares similar sustainable development challenges, including small population, remoteness, susceptibility to natural disasters, vulnerability to external shocks, and excessive dependence on international trade and foreign aid. Its growth and development is often further stymied by high transportation and communication costs, disproportionately expensive public administration and infrastructure due to its small size, and little to no opportunity to create economies of scale.

Solomon Islands has particular problems and concerns in dealing with the effects of climate change, variability and extreme events. As an LDC, it is recognised under Articles 4.8 and 4.9 of the United Nations Framework Convention on Climate Change (UNFCCC) as being the most vulnerable countries to the adverse impacts of climate change. Article 4, paragraph 9, of the Convention, particularly requires “That Parties shall take full account of the specific needs and special situations of the least developed countries in their actions with regard to funding and transfer of technology.”

Climate change will be a major impediment to the achievement of sustainable development in Solomon Islands, as all economic and social sectors are likely to be adversely affected, and the cost of adaptation will be disproportionately high, relative to gross domestic product (GDP). In attempting to integrate adaptation strategies into its sustainable development agenda, Solomon Islands will be confronted by many challenges including insufficient resources, prioritization of adaptation measures and uncertainties over climate change projections and adaptation strategies. The need to implement adaptation measures with some urgency has been often reinforced by the adverse impacts already being experienced in the country and highlighted in numerous national and regional workshops, meetings and conferences. It has been suggested that risk-reduction strategies together with other sectoral policy initiatives in areas such as sustainable development planning, disaster prevention and management, integrated coastal zone management and health care planning should be employed.

The successful adaptation in Solomon Islands will depend on supportive institutions, finance, information and technological support. Thus an adaptation strategy for the Solomon Islands should include a strategy for precautionary adaptation since it is difficult to predict far in advance how climate change will affect a particular site, sector or community. Thus adopting a “no regrets” adaptation measures would be justified even in the absence of climate change, as this would more than likely lead to better management of natural resources and

sustainable development. The Solomon Islands national adaptation programmes of action is therefore a channel of communication and dissemination of its urgent and immediate needs for adaptation to adverse effects of climate change.

NAPA will communicate priority activities addressing the urgent and immediate needs and concerns of Solomon Islands, relating to adaptation to the adverse effects of climate change. NAPA was prepared through a consultative process using a country team approach, a national synthesis of information covering the various sectors of the economy, a vulnerability analysis and community and/or village consultations. The consultative process facilitated the identification and prioritisation of key adaptation sectors. The key sectors covered in the synthesis of vulnerability and adaptation included the following: agriculture, water resources, health, energy, mining, education, training, public awareness and information, waste management, tourism, environment, forestry, mining, infrastructure development, trade and industry, fisheries and marine resources and human settlements.

The priority sectors where adaptation actions are urgently needed were identified through synthesis of existing information on vulnerability and adaptation, community consultations and from vulnerability analysis conducted by the NAPA Team. A multi-criteria analysis and ranking was used to prioritize the sectors. Based on the high ranking of the priority sectors (i.e. sectors with importance factor of 10 and above) and the greater likelihood of accessing funding support from the Least Developed Countries Fund for the implementation thereof, a total of seven project profiles were developed.

The project profiles have been designed to reflect the need for urgent and immediate adaptation actions in agriculture and food security, water supply and sanitation, education, awareness and information, human settlements, human health, waste management, fisheries and marine resources, infrastructure, coastal protection, and tourism. Agriculture and food security, water supply and sanitation, human settlements, human health, education, awareness and information have been included in one project, while each of the others (fisheries and marine resources, infrastructure, waste management, coastal protection and tourism) has one project profile. In addition, given the highly urgent need for adaptation action in low-lying and artificial islands it was decided to develop one project profile focusing on urgent adaptation action to be implemented in these areas.

## List of Acronyms

AR4	Fourth Assessment Report of the Intergovernmental Panel on Climate Change
BPoA	Barbados Programme of Action for Sustainable Development of Small Islands Developing States
CLIP	Climate and Livelihoods Project
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
CCD	Climate Change Division
CBD	Convention on Biological Diversity
CNURA	Coalition for National Unity and Rural Advancement
ENSO	El-Nino Southern Oscillation
EEZ	Exclusive Economic Zone
EVI	Economic Vulnerability Index
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GEF-PAS	Global Environment Facility-Pacific Alliance for Sustainability
GDP	Gross Domestic Product
GNI	Gross National Income
ICZM	Integrated Coastal Zone Management
INC	Initial National Communication
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
JPoI	Johannesburg Plan of Implementation
LDC	Least Developed Countries
LDCF	LDCs Fund
LEG	LDCs Expert Group
MCA	Multi-Criteria Analysis
MAL	Ministry of Agriculture and Livestock
MECM	Ministry of Environment, Conservation and Meteorology
MFMR	Ministry of Fisheries and Marine Resources
MHMS	MHMS and Medical Services
MEA	Multilateral Environmental Agreements
MSI	Mauritius Strategy for Implementation
MTDS	Medium Term Development Strategy 2008-2010
NAPA	National Adaptation Programme of Actions
NBSAP	National Biodiversity Strategy and Action Plan
NIS	National Implementation Strategy
NGO	Non-Government Organisation
PACC	Pacific Adaptation to Climate Change

PICCAP	Pacific Islands Climate Change Assistance Programme
PIGGAREP	Pacific islands Greenhouse Gas Abatement and Renewable Energy Project
PMT	Project Management Team
RGDP	Real Gross Domestic Products
RAF	Resource Allocation Framework
SIDS	Small Islands Developing States
SICHE	Solomon Islands College of Higher Education
SIMTRI	Solomon Islands Medical Training Institute
SIMS	Solomon Islands Meteorological Services
SPREP	Secretariat of the Pacific Regional Environment Programme
TeCOM	Technical Committee
UNCCD	United Nations Convention on Combating Desertification
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WWF	World Wildlife Fund for Conservation of Nature

## TABLE OF CONTENTS

<b>CHAPTER 1. INTRODUCTION AND SETTING.....</b>	<b>12</b>
1.1 LDCs AND THE UNFCCC .....	12
1.2 CLIMATE CHANGE CONTEXT .....	13
1.3 PHYSICAL CHARACTERISTICS.....	14
1.4 SOCIO-ECONOMIC SITUATION.....	20
1.5 KEY SECTORS AND ENVIRONMENTAL STRESS .....	22
<b>CHAPTER 2. FRAMEWORK FOR ADAPTATION PROGRAMME .....</b>	<b>25</b>
2.1 POLICY AND INSTITUTIONAL FRAMEWORK.....	26
2.2 SYNERGY WITH OTHER MULTILATERAL ENVIRONMENTAL AGREEMENTS.....	29
2.3 KEY VULNERABILITIES.....	29
2.3.1 <i>Agriculture</i> .....	29
2.3.2 <i>Water Resources</i> .....	33
2.3.3 <i>Human Health</i> .....	37
2.3.4 <i>Human Settlements</i> .....	39
2.3.5 <i>Energy</i> .....	42
2.3.6 <i>Fisheries and Marine Resources</i> .....	44
2.3.7 <i>Mining</i> .....	48
2.3.8 <i>Infrastructure Development</i> .....	51
2.3.9 <i>Education</i> .....	53
2.3.10 <i>Tourism</i> .....	55
2.3.11 <i>Trade and Industry</i> .....	56
2.3.12 <i>Forestry</i> .....	57
2.3.13 <i>Waste Management</i> .....	59
<b>CHAPTER 3. IDENTIFICATION OF KEY ADAPTATION NEEDS .....</b>	<b>61</b>
3.1 NATIONAL SYNTHESIS, NATIONAL COMMUNICATION AND OTHER DOCUMENTS .....	61
3.2 COMMUNITY CONSULTATIONS.....	61
3.3 GUIDELINES FOR COMMUNITY AND/OR VILLAGE CONSULTATIONS.....	63
3.4 OUTCOMES OF COMMUNITY AND/OR VILLAGE CONSULTATIONS .....	63
<b>CHAPTER 4. CRITERIA FOR SELECTING PRIORITY ACTIVITIES .....</b>	<b>67</b>
4.1 COUNTRY-DRIVEN CRITERIA.....	68
4.2 RANKING OF ADAPTATION OPTIONS .....	69
<b>CHAPTER 5. LIST OF PRIORITY ADAPTATION ACTIVITIES.....</b>	<b>72</b>
5.1 MANAGING THE IMPACTS OF, AND ENHANCING RESILIENCE TO, CLIMATE CHANGE AND SEA-LEVEL RISE, ON AGRICULTURE AND FOOD SECURITY, WATER SUPPLY AND SANITATION, HUMAN SETTLEMENTS, HUMAN HEALTH AND EDUCATION, AWARENES AND INFORMATION .....	72
5.2 CLIMATE CHANGE ADAPTATION ON LOW-LYING AND ARTIFICIALLY BUILT-UP ISLANDS IN MALAITA AND TEMOTU PROVINCES .....	85
5.3 WASTE MANAGEMENT .....	87
5.4 COASTAL PROTECTION.....	90
5.5 FISHERIES AND MARINE RESOURCES .....	93
5.6 INFRASTRUCTURE DEVELOPMENT .....	95
5.7 TOURISM.....	97

<b>CHAPTER 6. NAPA PREPARATION PROCESS.....</b>	<b>101</b>
6.1 NAPA INCEPTION.....	102
6.2 IMPLEMENTATION ARRANGEMENTS .....	105
6.3 INSTITUTIONAL ARRANGEMENTS .....	105
6.4 LINKING THE NAPA PROCESS WITH DEVELOPMENT PLANNING: THE ROLE OF NAPA TEAM ..	106
6.5 METHODOLOGIES AND TOOLS FOR NAPA PROCESS.....	108
6.6 PRESENTATION OF RESULTS .....	110
<b>CHAPTER 7. IMPLEMENTATION STRATEGY .....</b>	<b>112</b>
7.1 NAPA.....	112
7.2 POLICY INTEGRATION .....	113
<b>REFERENCES.....</b>	<b>114</b>
<b>ANNEX 1- ADAPTATION OPTIONS .....</b>	<b>119</b>
<b>ANNEX 2- COMMUNITIES AND VILLAGES CONSULTED .....</b>	<b>136</b>

## LIST OF FIGURES

Figure 1: Map of Solomon Islands .....	15
Figure 2: Temperature trend for Henderson and Auki Meteorological Station ..	16
Figure 3: Projection of global warming in the Pacific islands region up to 2090-2099.....	17
Figure 4: Rate of change in sea level height as measured by satellites over 10 years. The rate of increase in Melanesia region, at 8-10mm yr <sup>-1</sup> is three times the global average.....	18
Figure 5: Rainfall trend for seven meteorological stations .....	18
Figure 6: Tropical Cyclone Zoe in Solomon Islands .....	19
Figure 7: General trend for rainfall and river flow for Honiara station.....	34
Figure 8: “Wet” and “dry” Years for Honiara Station.....	36
Figure 9: Provinces covers during the Community Consultations .....	62
Figure 10: Organigram of NAPA Process showing management and institutional arrangements.....	106

## LIST OF TABLES

Table 1: Estimated real gross domestic product (Index 1985=100).....	21
Table 2: Calculating ranking and rating .....	70
Table 3 Summary of Project budgets.....	100

## LIST OF PICTURES

Picture 1: Agriculture on the artificially built-up Island - Lau Lagoon .....	31
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Picture 2: Water Quality in the low lying Islands - Rawaki, Western Province ...	35
Picture 3: Impacts of Sea level rise and tropical cyclones on the low lying Islands - Lordhowe and Tikopia .....	41
Picture 4: Coastal Erosion impacting on infrastructure - Fera airport, Isabel Province.....	52
Picture 5: Forest cover in Solomon Islands .....	58
Picture 6: Preparatory meeting for community consultations - NAPA Team .....	63
Picture 7: Community Consultations - Guadalcanal, Western Provinces .....	64
Picture 8: Low water mark -Lau Lagoon, Malaita Province.....	65

## CHAPTER 1. INTRODUCTION AND SETTING

As a Least Developed Country (LDC) and Small Island Developing State (SIDS)<sup>1</sup>, climate change is the most important environmental and developmental issue for Solomon Islands. Solomon Islands is a low-lying coastal country that shares with other SIDS and LDCs similar sustainable development challenges, including small population, remoteness, susceptibility to natural disasters, vulnerability to external shocks, and excessive dependence on international trade and foreign aid. Its growth and development is often further stymied by high transportation and communication costs, disproportionately expensive public administration and infrastructure due to its small size, and little to no opportunity to create economies of scale<sup>2</sup>.

Solomon Islands has particular problems and concerns in dealing with the effects of climate change, variability and extreme events. As an LDC, it is characterized by:

- a) A low-income based on a three-year average estimate of the gross national income (GNI) per capita under \$900.
- b) A human resource weakness with low Human Assets Index (HAI) based on indicators of: (a) nutrition; (b) health; (c) education; and (d) adult literacy; and
- c) An economic vulnerability, involving a low composite Economic Vulnerability Index (EVI) based on indicators of: (i) the instability of agricultural production; (ii) the instability of exports of goods and services; (iii) the economic importance of non-traditional activities (share of manufacturing and modern services in GDP); (iv) merchandise export concentration; and (v) the handicap of economic smallness; and the percentage of population displaced by natural disasters.

### *1.1 LDCs and the UNFCCC*

LDCs, along with SIDS are recognised under Articles 4.8 and 4.9 of the United Nations Framework Convention on Climate Change (UNFCCC) as being the most vulnerable countries to the adverse impacts of climate change. Article 4, paragraph 9, of the Convention, particularly requires “That Parties shall take full account of the specific needs and special situations of the LDCs in their actions with regard to funding and transfer of technology.”<sup>3</sup>

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<sup>1</sup> Solomon Islands is one of 12 countries which are both LDCs and SIDS

<sup>2</sup> See <http://www.un.org/esa/sustdev/sids/sidslst.htm>

<sup>3</sup> United Nations Framework Convention on Climate Change

The international community has recognised the vulnerability of LDCs to climate change and their low adaptive capacity. This is evident in the Marrakech Accords where a programme of work for the implementation of Article 4.9 was adopted by the Conference of the Parties (COP) to the UNFCCC (decision 5/CP.7). The programme of work for LDCs included the establishment of the LDCs Fund (LDCF) to support the preparation and implementation of the NAPA (NAPA). The LDCs Expert Group (LEG) is tasked to:

- a) Provide technical advice on the preparation and implementation strategy for NAPAs,
- b) Advise on capacity-building needs for the preparation and implementation of NAPA,
- c) Facilitate exchange of information and promote regional synergies with other multilateral environmental agreements (MEA), and
- d) Advise on the mainstreaming of NAPA into national development planning.

The COP also adopted the “Guidelines for the preparation of NAPA” in decision 28/CP.7 and invited the LDCs to use these guidelines, in accordance with their national circumstances, in preparing their NAPA.

NAPA will communicate priority activities addressing the urgent and immediate needs and concerns of LDCs, relating to adaptation to the adverse effects of climate change. In this context it is considered that Solomon Islands has a low adaptive capacity and therefore will require urgent and immediate support and actions to adapt to current and projected adverse effects of climate change. Thus any further delay in implementing activities identified and prioritised through NAPA process would increase its vulnerability and lead to increased costs (economic, social and cultural) at a later stage.

## ***1.2 Climate Change Context***

As with other LDCs and SIDS, climate change will be a major impediment to the achievement of sustainable development in Solomon Islands, as all economic and social sectors are likely to be adversely affected, and the cost of adaptation will be disproportionately high, relative to gross domestic product (GDP). In attempting to integrate adaptation strategies into its sustainable development agenda, Solomon Islands will be confronted by many challenges including insufficient resources, prioritization of adaptation measures and uncertainties over climate change projections and adaptation strategies. The need to implement adaptation measures with some urgency has been often reinforced by

the adverse impacts already being experienced in the country and highlighted in numerous national and regional workshops, meetings and conferences. It has been suggested that risk-reduction strategies together with other sectoral policy initiatives in areas such as sustainable development planning, disaster prevention and management, integrated coastal zone management and health care planning should be employed.

It can be argued that successful adaptation in small islands and indeed in Solomon Islands will depend on supportive institutions, finance, information and technological support. Thus an adaptation strategy for the Solomon Islands should include a strategy for precautionary adaptation since it is difficult to predict far in advance how climate change will affect a particular site, sector or community. Thus adopting a “no regrets” adaptation measures would be justified even in the absence of climate change, as this would more than likely lead to better management of natural resources and sustainable development. The Solomon Islands NAPA is therefore a channel of communication and dissemination of its urgent and immediate needs for adaptation to adverse effects of climate change.

### *1.3 Physical Characteristics*

The Solomon Islands is located between latitudes 5° South and 12° South and longitudes 152° East and 163° East in the Pacific Ocean, encompassing a total land area of 28, 785 square kilometres (km<sup>2</sup>) and an Exclusive Economic Zone (EEZ) of 1.34 million km<sup>2</sup>. The land area of the Solomon Islands consists of a double chain of six large islands that make up a total of 997 islands. The double chain of islands is described as a fragmented island arc situated along the boundary between the Ontong Java Plateau-Central Pacific Basin and the Solomon Sea-Woodlark-Torres Basins. A composite basin separates the double chain of islands that make up the main archipelago of the Solomon Islands and is the segment of the Melanesian Island arch complex that separates the Pacific Ocean from the Coral Sea and Solomon Sea (Vedder, 1984).

The EEZ consists of a complex area of troughs, basins and ridges that underlies the Coral Sea south of the island chains. To the north and east of the Solomon Islands archipelago, lie less well-defined trench systems. Exploration and assessment of these troughs and basins reveal mineral potential of polymetallic sulphides and hydrocarbons. The magnitude of petroleum potential in the Solomon Islands is yet to be determined, but their hydrocarbon potential has been found to be substantial. Sustainable development of this hydrocarbon potential remains a concern of the Solomon Islands government.

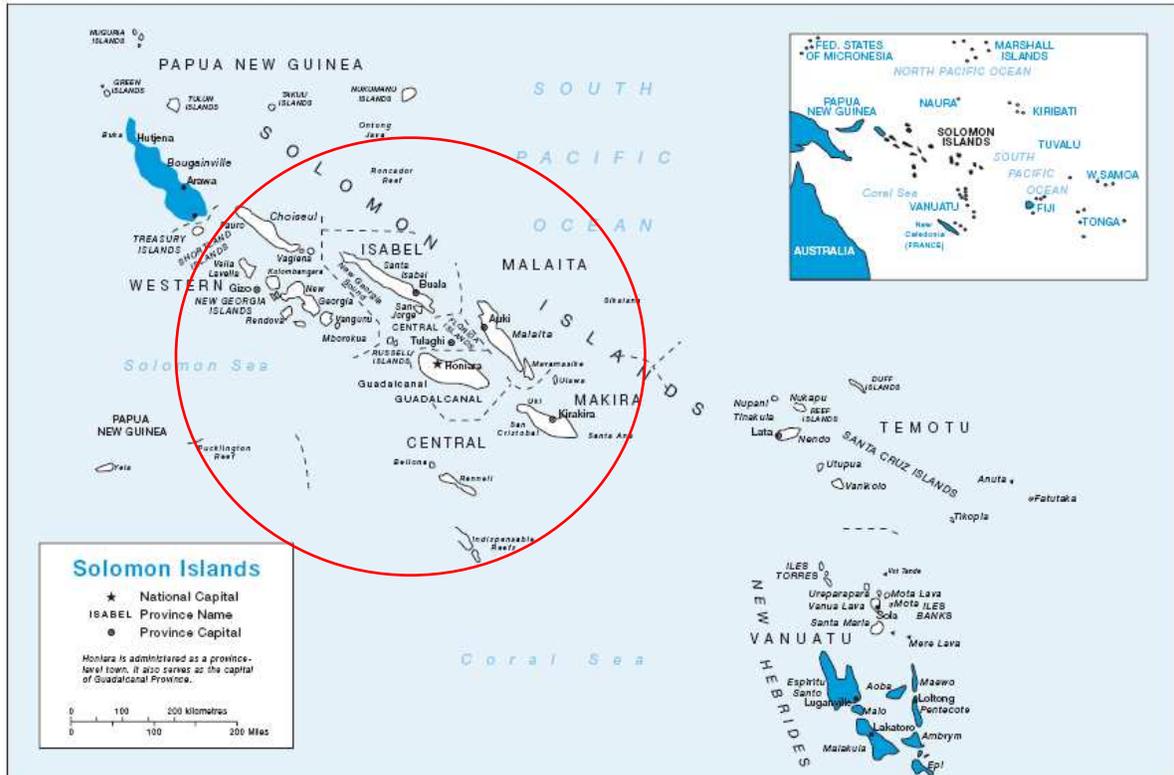
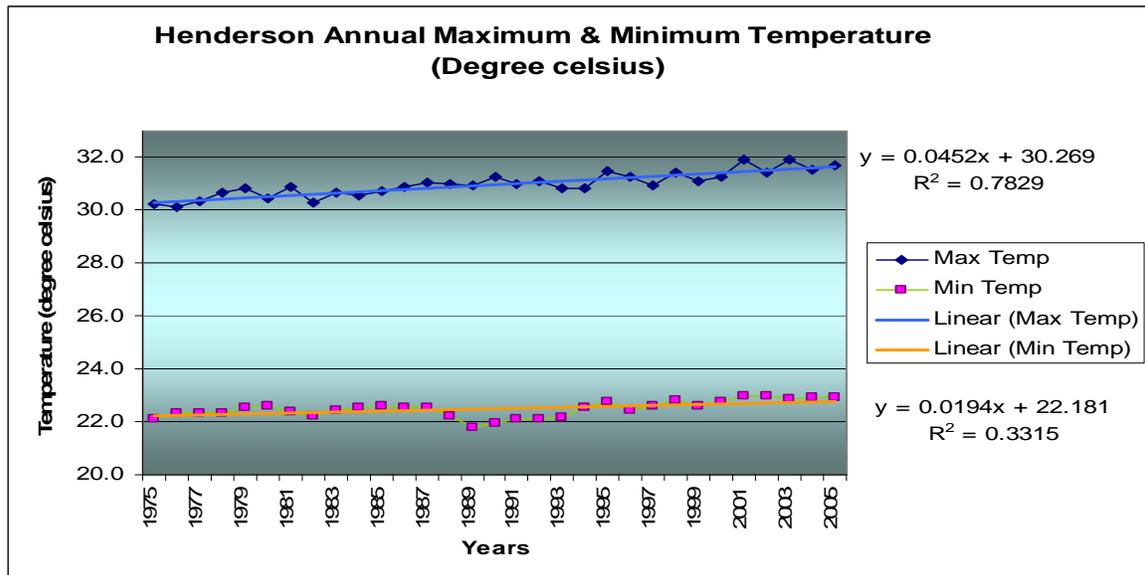
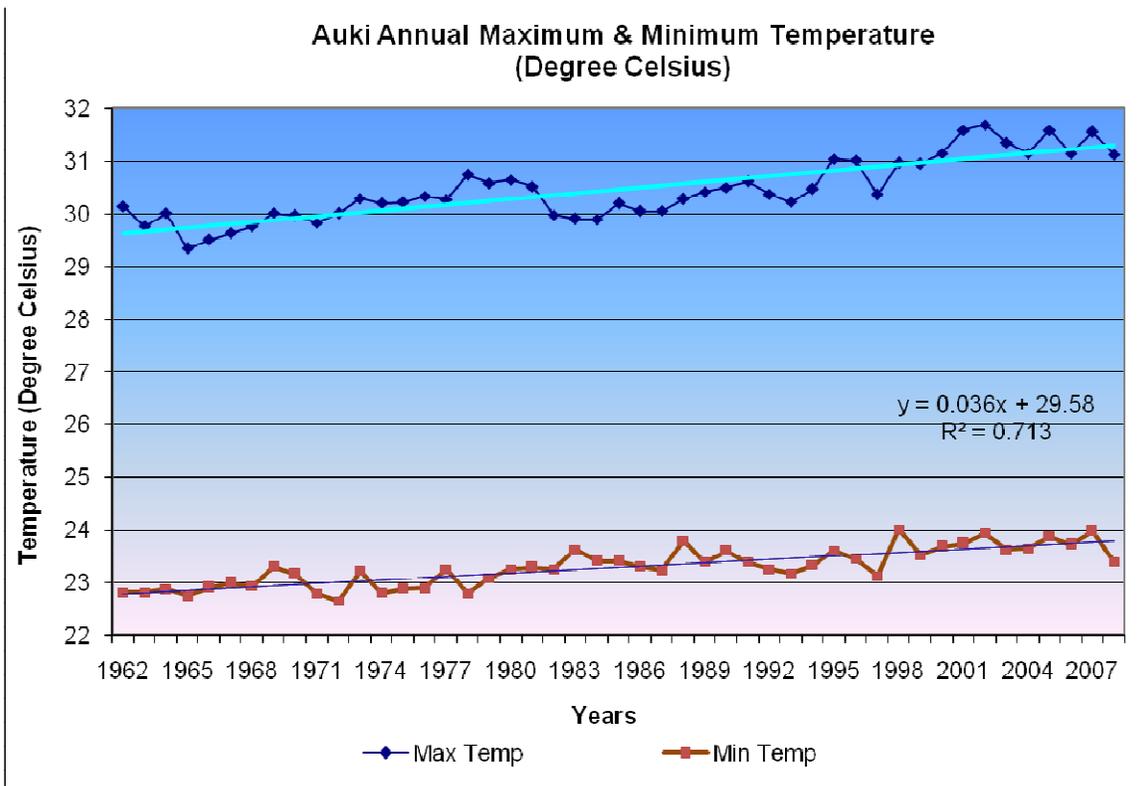


Figure 1: Map of Solomon Islands

Solomon Islands has a climate humid and warm with mean daily maximum temperature of about 30°C and a mean daily minimum of about 23°C. Rainfall distribution is quite varied with annual average rainfall normally ranges from 3000mm to 5000mm. Often drought in the country is associated with the El Niño Southern Oscillation phenomenon (ENSO). From about December to March, a period of west to north-westerly monsoonal winds and abundant rainfall can be expected as well as a period where tropical cyclones form and affect the islands. The south-east trade winds (SE trades) blows from around May to October and trigger higher rainfall particularly on the windward side of the islands.

The annual mean temperature trends for two locations indicate a warming trend since the 1950s (see figure 2). This is consistent with warming trend elsewhere in the Pacific islands region.



**Figure 2: Temperature trend for Henderson and Auki Meteorological Station.**

The general 20<sup>th</sup> century surface air temperature warming in the South Pacific region amounts to about 0.05<sup>0</sup>C/decade, which is slightly less than the global mean value. This warming trend has increased to about 0.3<sup>0</sup>C/decade during the last 30 years. Comparing the climate conditions between 2090-2100 with the present-day conditions, more than 66% of the AR4 (CMIP-3) climate model projections using an A1B scenario (modified “business-as-usual”, i.e. rapid

growth, convergent world, with more balanced energy sources) show an increase of precipitation in the northern Melanesian region, whereas more than 90% of the model experiments predict a summer drying in the southern areas of Melanesia. These projected precipitation trends are accompanied by a multi-model ensemble mean surface air-temperature increase of about 2°C in the Melanesian region<sup>4</sup> (Figure 3).

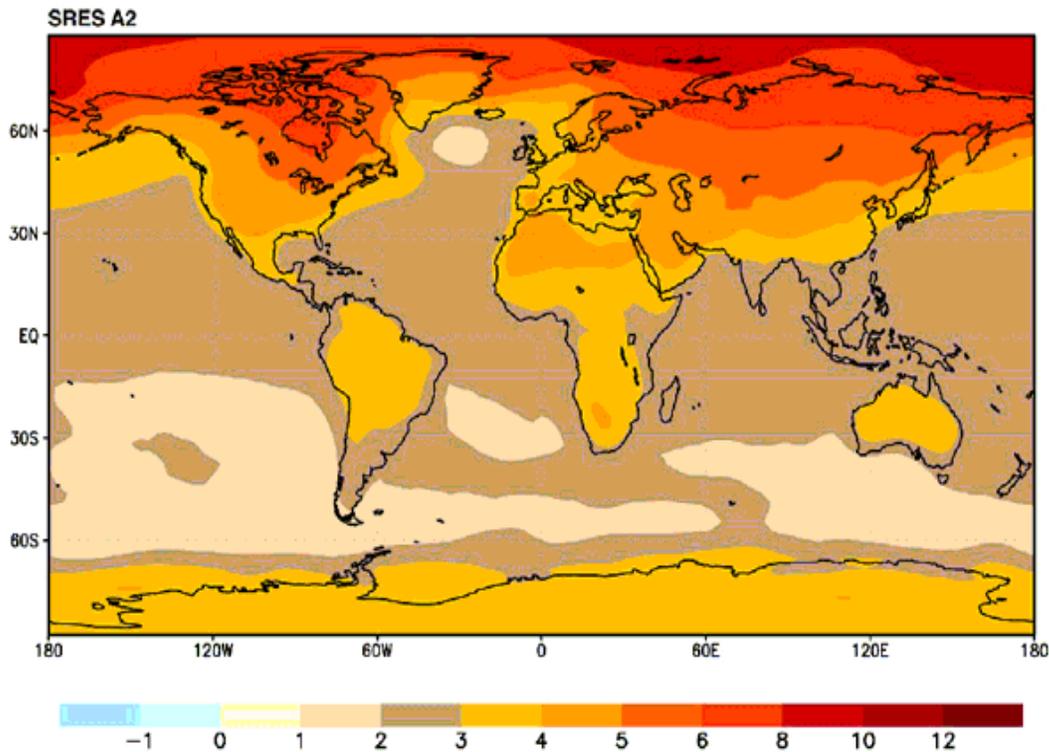


Figure 3: Projection of global warming in the Pacific islands region up to 2090-2099.

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (AR4) estimates that sea-level rise over the last century was  $1.7 \pm 0.5$ mm/yr. However from 1961-2003, the average rate of sea level rise is estimated at  $1.8 \pm 0.5$ mm/yr. Global projection of sea level rise estimated by AR4 ranges from 0.18m to 0.59m (IPCC 2007). Thermal expansion accounts for about 75% of the total sea level rise. Figure 4 shows the rate of sea level rise in the last 10 years up to 2006 from satellite records.

In the southwest Pacific (Melanesia region) the rate of change of sea level height as measured by satellites over the 10 years was at 8-10mm/yr, approximately three times the global average. In more recent measurements of sea level in

<sup>4</sup> Melanesia region includes Papua New Guinea, Solomon Islands, Vanuatu and New Caledonia.

Solomon Islands from 1994 up to June 2008 indicates the net relative sea level trend at 7.6mm/yr which two time average of the trend up to June 2007.

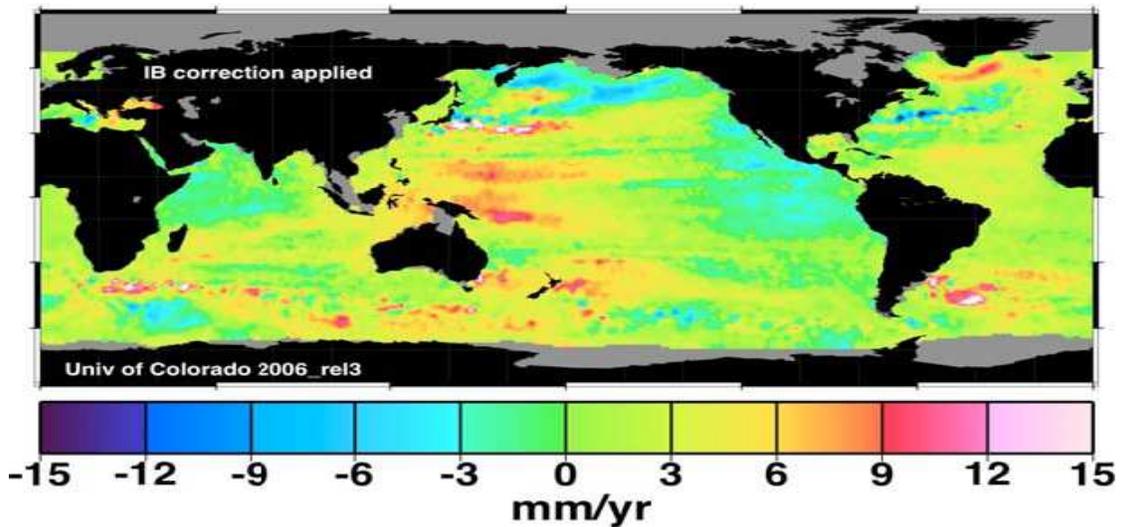


Figure 4: Rate of change in sea level height as measured by satellites over 10 years. The rate of increase in Melanesia region, at 8-10mm yr<sup>-1</sup> is three times the global average.

While temperature records show a generally warming trend rainfall records show a downward trend (Figure 5).

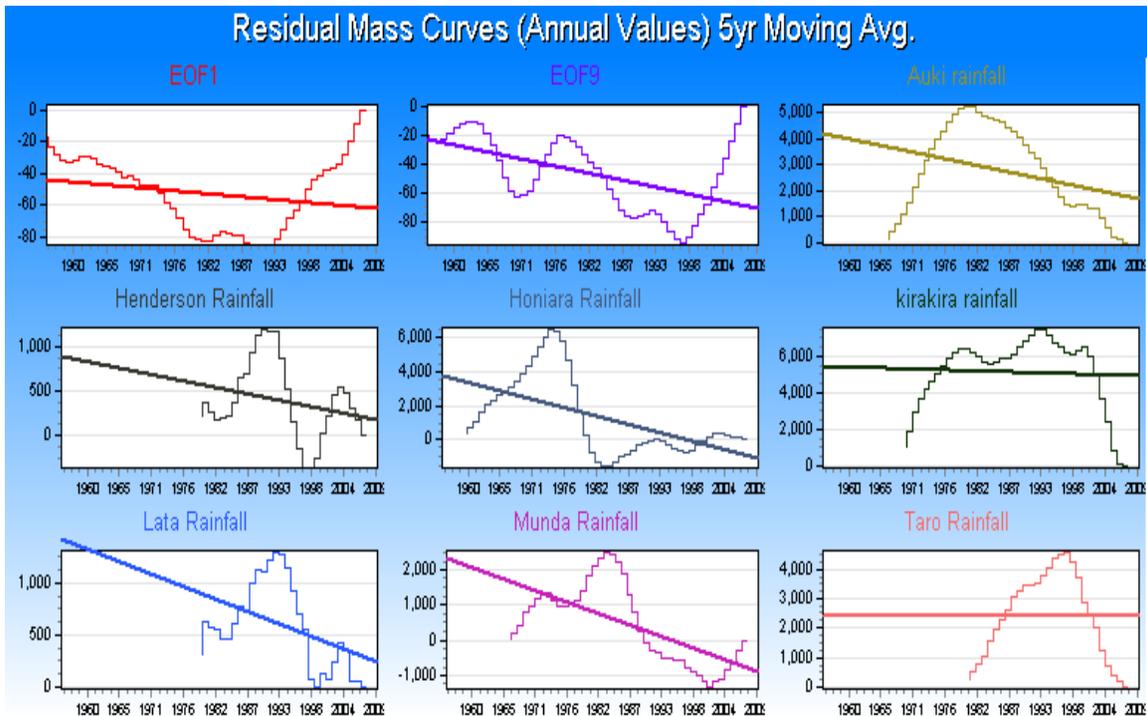


Figure 5: Rainfall trend for seven meteorological stations

The country also experiences severe tropical cyclones during the summer months of December to February, and is also vulnerable to anomalously long dry spells associated with the warm phase of the El Nino-Southern Oscillation (ENSO). Solomon Islands is also highly vulnerable to other extreme climate events including, for example, coral bleaching associated with high ocean surface temperatures and/or extremely low tides. The impacts of climate-related events are felt right across the nation's economic, social and environmental systems, thus making future changes in climate, including extreme events, an issue of great concern nationally.

Severe Category 5 Tropical Cyclone Zoë devastated the two most remote islands of Tikopia and Anuta of the Temotu Province on 28<sup>th</sup> and 29<sup>th</sup> December 2002. It left behind tons of debris and severe damages to the environment, agriculture and community productivity, food, water supply, health and education. Miraculously there were no major casualties or death recorded from the two islands. Nonetheless, devastation and destructions caused by the cyclone were staggering. In monetary terms (local currency), the response effort cost about a million dollars (Solomon Dollars SBD\$826,500.00) whilst the relief and initial rehabilitation activities attracted millions in dollars (Solomon Dollars SBD\$7,302,680.00). But the required rehabilitation activities are nowhere near complete – the rehabilitation effort will require several more years to be achieved.

Communities living on these islands were known to have been without two-way communication with national and international weather services and there was a very real possibility that they had been unwarned and unprepared prior to the cyclone actually reaching land fall on 28<sup>th</sup> December 2002. That was despite the first tropical cyclone warning was issued on 25<sup>th</sup> December at 03:00 Zulu (universal standard time). The system then has a sustained wind speed of 35 knots gusting up to 45 knots at around 11 degrees south of the latitude and 177.7 degrees east of the longitude. By 27<sup>th</sup> December at 03:00 Zulu the system was located at 11.1 degrees south of the latitude and 172.6 degrees east of the longitude. By that time it has already developed into a severe cyclone with sustained winds at 95 knots and gusts reaching 115 knots. By 29<sup>th</sup> December when it has already gone over the islands of Anuta and Tikopia, it already has a wind strength of 120knots with gusts reaching 145 knots.

Figure 6: Tropical Cyclone Zoe in Solomon Islands

## 1.4 Socio-economic Situation

The country had an estimated population of 508,000 in 2007. The projected population is 607,000 by 2014. Of the nine provinces<sup>5</sup> in the country Malaita is the most populous and Renbel the least populous. The population of Solomon Islands is predominantly Melanesian (about 95%) although there are smaller Polynesian, Micronesian, Chinese and European communities. The social structure is extremely diverse and complex and varies from island to island. Different customs - codes of behaviour, systems of land tenure, leadership rules, blends of traditional and world religions, marriage rules and so on - exist throughout the nation. Most communities recognise strong kinship links and obligations with the broad language group.

The economy is largely dependent on agriculture, forestry, and fishing. For a high proportion of the population (mainly village-based), the Solomon Islands economy involves the production of subsistence foods and other items for personal consumption. The main item of production for cash at the village level is copra (the dried flesh of coconut), but also significant in some areas is cocoa, market vegetables, and marine products including fish and shells. Export commodities include gold, copra, wood and fish products, and cocoa. Logging continues to generate revenue for the Solomon Islands while coconut products and gold have been stagnant since 1999 and 2000 respectively.

The agricultural cash economy is a legacy from the British colonial period. After the establishment of the British Solomon Islands Protectorate in 1893, the colonial administration facilitated the establishment of plantations, usually run by British settlers, and the recruitment of local labor. While there were some attempts to introduce new crops into the subsistence economy, the colonial administration took few initiatives to diversify the economy before independence in 1978.

During the 1970s the logging, fishing, and rice industries increased production as a result of new private investments and international aid programs. Through the 1980s and 1990s the two most significant items of production for export were timber and fish. Ethnic tensions on Guadalcanal in 1999 and 2000 caused some disruptions, but a peace settlement was reached in October 2000, and these economic activities are projected to reach previous levels. Large-scale mining started in 1998, and this sector is expected to expand if political stability is maintained.

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<sup>5</sup> Central, Choiseul, Guadalcanal, Isabel, Makira, Malaita, Rennel, Temotu, and Western Provinces.

Various small-scale manufacturing enterprises in recent decades have resulted in some import substitution (replacing imports of some food, furniture, and similar items with locally made products) and limited exports of food, beverages, construction materials, and furniture. Local processing within the fishing industry is also important.

Services have been mainly confined to the public sector, particularly in civil administration and education. Tourism has remained a small-scale activity, partly because the government did not actively promote tourism as an economic alternative until the mid-1990s. Most manufactured goods and petroleum products must be imported. The islands are rich in undeveloped mineral resources such as lead, zinc, nickel, copper, bauxite and gold.

**Table 1: Estimated real gross domestic product (Index 1985=100)**

Industry	2004	2005	2006	2007
Agriculture	106.2	118.1	120.5	146.4
Forestry	263.6	288.3	306.3	381.5
Fishing	115.5	104.4	130.6	110.8
Mining & Exploration	-3.3	-3.3	-3.3	-3.3
Manufacturing	135.8	137.1	141.0	147.6
Electricity & Water	213.2	250.6	255.0	285.6
Construction	45.6	52.9	70.6	94.6
Retail & Wholesale Trade	140.9	143.3	143.3	152.6
Transport & Communication	143.9	146.7	187.6	225.9
Finance	229.4	231.7	236.0	257.8
Other Services	126.4	135.4	144.2	153.8
Index of Monetary GDP Production	139.8	147.5	158.3	178.2
Annual % Movement	9.5	5.6	7.4	12.5
Index of Primary Production (Min)	141.7	151.2	162.4	188.4
Annual % Movement	16.9	6.7	7.4	12.5
Non-Monetary Food	165.0	169.6	174.3	179.2
Non-Monetary Construction.	160.0	164.4	169.0	173.8
Non-Monetary- GDP Index	164.6	169.2	173.9	178.8
Index of Total GDP Production	144.6	151.8	161.1	177.6
Annual % Movement (Real)	8.0	5.0	6.1	10.3

*Source: 2007 Central Bank of Solomon Islands Annual Report*

Estimated Real Gross Domestic Product (RGDP) grew by 10.3% in 2007 to \$368 million (at 1985 constant prices), the highest rate of growth since 1992 consolidating consecutive growth rates of over 5% in the previous four years. The economic expansion in 2007 was a substantial increase from the 6.1% growth in 2006, a manifestation of a strong performance achieved by most sectors of the economy. In terms of current prices, nominal gross domestic product grew by 18.8% to \$3,264 million during the year. Table 1 below outlines the GDP growth in the last four years to 2007. It shows that agriculture, forestry, and

manufacturing sectors have grown steadily while mining and exploration which were disrupted during the height of the ethnic tension had stagnated.

### *1.5 Key Sectors and Environmental Stress*

The key economic sectors are agriculture, forestry, fishing, mining and exploration, manufacturing, electricity and water, construction, transport and communication, retail and wholesale trade and finance, as outlined in Table 1 above. In respect of adverse impacts of climate change on biophysical and human systems, the following sectors are important: environment; agriculture; water resources; coastal resources; biodiversity; terrestrial and marine ecosystems (including forests, mangroves and coral reefs), human health; energy; waste; human settlements; and international trade.

Many of the environmental problems and stresses result from exploitative and extractive/destructive industries and/or activities. These activities include logging, land clearing, adverse effects of climate change and sea-level rise, urban development and construction, population growth, waste disposal system, subsistence farming practices, invasive species, over-fishing and marine resource exploitation. These activities contribute to loss of biodiversity, loss of species, land and soil degradation, depletion of fish stocks, ecosystem destruction and habitat loss, loss of water quality and quantity, coastal erosion and degradation, sedimentation, loss of soil fertility, saltwater intrusion and increase in disease incidence.

A major environmental concern has been the impact of forest degradation through large scale logging at the rate of about one million cubic meters in the last three years (2005 - 2007) and land clearing for subsistence agriculture as result of the rapid growth of the country's population. The unsustainable harvesting of marine resources is also a major issue of concern with most economic species without proper management plans to ensure sustainable harvesting. Major environment Non Government Organisation (NGO) partners have been undertaking marine conservation activities and program related to specific species protection.

Response strategies across all sectors featured the need to strengthen current government frameworks and policies for them to be able to respond comprehensively to climate change, including the establishment of coordination mechanisms.

Awareness and education were strong themes for each sector with strong recommendations made to integrate climate change into the formal education curriculum as well as into existing community awareness programs.

The need for detailed assessments of climate impacts and risks for each sector was a consistent response strategy, and without this data and information the meaningful integration of climate change impacts into future plans and projects would be a challenge.

Land issues are a potential future challenge to adaptation projects, as has been found in some water sector projects, and these issues must be thoroughly worked through before physical projects are undertaken.

Generally Solomon Islands will suffer from and is threatened by the vagaries of climate change and sea-level rise over the long term. In fact many of the adverse impacts are already being experienced and these will be further exacerbated by the future climate change. The response in Solomon Islands to climate change is to build the strength of existing institutions, and all initiatives must be mindful of the current capacity constraints in terms of both the weak legislative and policy frameworks and the limited financial and human capacity. In particular, the following should be noted:

- A. Climate change impacts cut across all the sectors considered here, with potentially severe effects in the particularly vulnerable areas of atoll islands, lowland coastal areas and urban areas
- B. The water, agriculture, health, environment and forest sector are already under severe stresses that will be exacerbated by climate change
- C. The mining and tourism industry have potential to offer more to the economic development of Solomon Islands but their potential is under threat from climate change
- D. Poor waste management, forestry, agriculture and mining practices as well as urbanization and population growth, will exacerbate the effects of climate change
- E. Out of date or non-functional legislation and policies related to most sectors means that there is already an unclear framework within which to operate. While this is a limitation it could also be an opportunity as climate change could be integrated into the reviewed versions.
- F. Lack of human capacity and in most cases financial capacity to undertake current work is already a major limitation to current work programs
- G. Lack of coordination within the sectors is a theme that is reflected in most sectors, in part due to weak government frameworks and capacity constraints. In the case of the Forest Sector lack of coordination is also due to conflict over land ownership and resources.
- H. There is a lack of awareness on climate change in general, and its impacts on the specific sectors in particular across all levels of the government and the public and even within the relevant sectors

- I. Awareness programs need to be developed that are specific to the cultural sensitivities of Solomon Islands.
- J. Lack of specific information and data on current and future vulnerability and risks across the country and across the sectors is hindering meaningful action on climate change. This issue is exacerbated by the lack of sector specific information and data, or information and data management systems, in key sectors such as health and water.

## CHAPTER 2. FRAMEWORK FOR ADAPTATION PROGRAMME

Solomon Islands ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 28 December 1994, and submitted its Initial National Communication (INC) to the UNFCCC on 30 September 2004. Following the preparation of its INC, the country has initiated efforts to create an institutional set-up that seeks to mainstream climate change issues into the national programme frameworks.

Ratification of the UNFCCC is one step forward in terms of commitment to addressing climate change and related issues. Solomon Islands is also a Party to many other UN conventions, such as these, among others: biological diversity, biosafety, Persistent Organic Pollutants (POPs), and combating desertification. The country also ratified the Kyoto Protocol on 13 March 2003. Solomon Islands has embarked on the implementation of sustainable development programmes which have strong linkages to its reporting commitments under other multilateral environmental agreements. These reports include its contribution to World Summit on Sustainable Development (WSSD) and Johannesburg Plan of Implementation (JPOI), Barbados Programme of Action on Sustainable Development of Small Islands Developing States (BPoA), Mauritius Strategy for Implementation (MSI), and National Biodiversity Strategy Action Plan (NBSAP) under the Convention on Biological Diversity (CBD). With the support of the Global Environment Facility (GEF), Solomon Islands has completed the assessment of its capacity building needs relating to the implementation of the UNFCCC, CBD and the United Nations Convention to Combat Desertification (UNCCD).

A number of climate change programmes, projects and activities have been carried out in Solomon Islands since the entry into force of the UNFCCC. Solomon Islands was one of ten countries of the Pacific who participated in the Pacific Islands Climate Change Assistance Programme (PICCAP) from 1997 to 2001. PICCAP was a multi-country regional enabling activity project funded by the GEF, implemented by United Nations Development Programme (UNDP) and executed by Secretariat of the Pacific Regional Environment Programme (SPREP) to assist participating countries to prepare their initial communications under the UNFCCC.

## ***2.1 Policy and Institutional Framework***

The overall framework for adaptation to climate change and for development in Solomon Islands is embedded in the Medium Term Development Strategy 2008-2010 (MTDS). The aim and purpose of the MTDS is the belief by the Coalition for National Unity and Rural Advancement (CNURA) Government that it is only when Solomon Islanders benefit from 'development', that the government can say truly that it is addressing national needs. "In other words, we - the people - should be the center of development. Whatever form development takes, the CNURA Government will ensure that our people will remain our central focus in terms of its aims and its purposes" (MTDS 2008-2010).

The mission of the CNURA Government is to further strengthen development through a bottom-up and holistic approach that encompasses the empowerment of the people through rural advancement strategies, the pursuit of the Millennium Development Goals (MDGs), the revitalization of the economy, improved law and order, effective service delivery and the devolution of powers and functions and decision-making authority to the periphery. One of its key national objectives is to ensure the sustainable utilization and conservation of the natural resources and environment and successful adaptation to climate change.

To give impetus to the objective, the CNURA Government established the Ministry for Environment, Conservation and Meteorology (MECM) whose main functions are concerned with Environment and Conservation; National Parks and Wildlife; Ecological Studies; Global Warming and Rising Sea Level; and Meteorological Services. The MECM also serves as a National Focal Point for all international, regional Conventions, Treaties and Protocols relating to Environment, Conservation, Global Warming, Climate Change and Meteorology.

The MECM also established a Climate Change Division (CCD) to deal with all climate change issues and concerns and also to translate CNURA policies into actions. Thus one of MECM's strategic priorities is to develop a national adaptation plan that addresses climate change issues, particularly for the most vulnerable communities. NAPA process is therefore being implemented through this office and will help facilitate the integration of climate change issues in national development plans and strategies. MECM is currently executing the preparation of NAPA, removal of barriers for the adoption of renewable energy technologies through the Pacific Islands Greenhouse Gas Abatement and Renewable Energy Project (PIGGAREP) and is about to begin implementing adaptation actions in enhancing resilience to climate change and improving food security through the Pacific Adaptation to Climate Change Project (PACC). Other projects relate to the preparation of the second national communication

and the recently completed national capacity self-assessment for the implementation of the UNFCCC, CBD and the UNCCD.

Under the Global Environment Facility's (GEF) Resource Allocation Framework (RAF) Solomon Islands is eligible for national allocation for funding activities relating to climate change and biodiversity focal areas. These funds have been channeled through the GEF-Pacific Alliance for Sustainability (GEF-PAS). The principal objective of GEF-PAS programme is to increase the efficiency and effectiveness of GEF support to Pacific Islands Countries (PICs). It is anticipated that goals of regional environmental programmes and national sustainable development initiatives will be accomplished with execution of the GEF-PAS programme which is a comprehensive, regionally coordinated and nationally executed investment programme. Several project information forms (PIF) have been completed and submitted to the GEF for funding under GEF-PAS.

Given the potential for numerous GEF-funded projects and the limited individual and institutional capacity for implementation of these projects the MECM established a Technical Committee (TeCom) to provide technical, scientific and policy oversight to the implementation of such projects. The TeCom is based on the principles of Multi-Stakeholder Approach and is consistent with the spirit of partnership that the MECM affirmed in its Corporate Plan 2008-2010.

Co-operating Ministries in the TeCOM are Fisheries and Marine Resources; Forestry; Mines, Energy and Rural Electrification; Commerce, Industries and Employment; Rural Development; Agriculture and Livestock; Lands and Survey; National Planning and Aid Coordination; and Health and Medical Services. Supporting non Government Organizations are The Nature Conservancy, The World Fish and The Wildlife Fund for Nature.

The roles and functions are:

- 1) To identify national strategies in key focal areas of biological diversity and inclusion of these national strategies in Solomon Islands component of the Coral Triangle Initiative. The strategies will come in the following focal areas:
  - a) Climate change
  - b) Fisheries and Marine Resources
  - c) Environment
  - d) Conservation

- 2) To identify national strategies for climate change mitigation with views of coming up with Solomon Islands component of the Regional Renewable Project
- 3) To identify national strategies for climate change adaptation with views of implementing the NAPA
- 4) To identify national strategies for integrated water resources and waste management
- 5) To identify national strategies for monitoring POPs and identify alternatives for DDT

The TeCom is chaired by the Permanent Secretary, MECM, who is also the GEF Political and Operational Focal Point. Other Members of the Committee are:

- a) Permanent Secretary/Fisheries and Marine Resources, Vice Chair
- b) Under Secretary/Forestry
- c) Under Secretary/Health
- d) Under Secretary/Commerce, Industry and Employment
- e) Under Secretary/National Planning
- f) Commissioner of Lands
- g) Commissioner of Forests
- h) Director/Environment and Conservation
- i) Director/Climate Change
- j) Director/Meteorology
- k) Director/Fisheries
- l) Director/Energy
- m) Director/Water Resources
- n) Director/SIMTRI
- o) Director/Trade
- p) Director/Rural Development
- q) Non Government Organizations
  - i. The Nature Conservancy
  - ii. The Wild Life Fund for Nature
  - iii. The World Fish

The TeCOM is seen as a vehicle for mainstreaming climate change into national, provincial and sector policies, strategies and plans. TeCOM will work closely with the Climate Change Division to develop a programme of work which will lead to highlighting and integrating climate change issues and concerns into sector policies, strategies, programmes and plans. This programme of work for climate change integration will involve a fully consultative and inclusive process.

## *2.2 Synergy with other Multilateral Environmental Agreements*

Many of the issues, concerns and needs identified in the NAPA process could be further elaborated in the preparation of second national communication. Of particular note, is the similarity in approaches that highlighted the immediate needs and concerns relating to identification and prioritization of adaptation options, strategies and measures in the preparation of second national communication.

NAPA preparation was based on a multi-stakeholder consultation which identified a number of important sectors of the economy and livelihoods which would be adversely affected by climate change, climate variability and sea-level rise. Adaptation and capacity building are considered as being key cross-cutting issues that would promote synergy between and among the UNFCCC and the Convention on Biological Diversity (CBD) and the Convention on Combating Desertification (UNCCD). Adaptation to climate change has very close linkages with activities relating to the preparation of the National Biodiversity Strategy and Action Plan (NBSAP) under CBD and National Action Plan under UNCCD. Activities relating to the preparation of vulnerability and adaptation assessments for national communication will therefore have closer links on adaptation and capacity building issues with other reporting requirements.

## *2.3 Key Vulnerabilities*

Information in this section is derived from the sectoral reports produced by the NAPA Team. The reports were produced as part of a national synthesis. Thus the information presented is organised by key sectors: agriculture; water resources; energy; human health; mining; fisheries and marine resources; human settlements, infrastructure; forestry; waste; education; environment and tourism.

### *2.3.1 Agriculture*

84% of Solomon Islanders live in rural areas (World Bank 2006) and 85% of these rural dwellers are dependent on subsistence agriculture and fisheries (UNDP and SIG u.d). There has been an increase in movement of people to Honiara in recent years but the majority still lives a village lifestyle. Women play a central role in agricultural production.

Intensive agriculture plantations such as palm oil have grown in size, number and intensity in the last five years. Thus agriculture is the largest employer in the country. Eighty to ninety percent of the country's revenue comes from natural

resources such as timber, fish, copra, cocoa and palm oil. (Central Bank Solomon Islands 2007).

Weather patterns are important for agricultural productivity and food security. Around 60% of the land is either hilly or mountainous, with only narrow coastal plains where the majority of the population lives. Only 1% of the land is arable. Coastal communities - the majority of communities in Solomon Islands - rely on low land coastal plain gardens or on gardens on higher land, sometimes on steep slopes or in cleared forest areas susceptible to soil erosion and landslides (UNDP and SIG u.d).

Small farming units have increasingly moved from traditional subsistence farming to cash crop and market crops. Also, to avoid land disputes which are a significant issue in Solomon Islands leading in part to the ethnic tensions of 1998 - 2003, families are reducing the shifting nature of agriculture, shortening fallow periods and moving to more marginal lands (steep and/or poor soils) to be able to continue to grow produce. Fallow periods have reduced from 15-20 years to 0-5 years.

These trends combined with increasing population pressure, slash and burn farming practices, and soil erosion contribute to pollution of water and coastal systems, and periodic outbreaks of pests, diseases and invasive species. As a result of all of these factors are widespread decline in soil structure, soil erosion, a loss of soil fertility and a decline in crop yields, (UNCCD Report 2002)

The Ministry of Agriculture and Livestock (MAL) aims to enhance and promote a sustainable agriculture and rural development in Solomon Islands for food sovereignty and a better standard of living' (Ministry of Agriculture and Livestock 2007). The Policy Goal of the Ministry of Agriculture and Livestock is to improve the agriculture sector by providing extension, education, regulation, research and associated activities to increase food production, food security and standards, and economic recovery and development (CNURA 2008). As well as agricultural productivity (both commercial and subsistence) MAL aims to contain destructive pests such as the giant African snail, Asian honeybee and the fruit fly. It also conducts research on new crops and trains agriculturalists.

The Agricultural Research Division of the MAL is the mandated research arm of the Government and it aims to provide practical answers on agricultural production (Agricultural Research and Development Division 2006). Research addresses various cropping systems not just the traditional root crops and it has established four Field Experiment Stations in different climatic zones. It plays an important role in seeking food crops that can tolerate drought, flooding or long

wet periods (Galo, unpublished) It also develops participatory research work and disseminates the results across the country.

Whilst climate change is not specifically mentioned in the MAL of the CNURA Policy Document, it does include specific activities that are relevant to climate change such as the establishment of disaster relief food banks at strategic provincial sites (Saelea 2007). There is a need for greater attention on climate change impacts on agriculture through national policies and at provincial and local levels.



**Picture 1: Agriculture on the artificially built-up Island - Lau Lagoon**

The Agriculture Development Policy 2008–2028 is in development with funding support from FAO. It is a first attempt at putting in place a framework to guide agricultural development in Solomon Islands for the next 20 years and there is scope to include climate change impact although it is not clear if this is being done.

The Ministry is working with the NDMO and Provincial Agriculture to set up disaster relief food banks at strategic provincial sites, dispersal of planting materials, seeds and tools to disaster affected areas. It also works on long-term disaster recovery proposals. Other specific actions relating to climate change are:

- a) Sustainable Land Management (SLM) programmes address land degradation with demonstration projects on an Integrated Approach to Sustainable Land Use Farming.
- b) Coastal erosion, soil erosion, drought and importantly with Capacity Building for SLM.
- c) Development of Sustainable Agriculture in the Pacific Project looks at land degradation, soil fertility enhancement, vegetable production and trade in the highlands of Malaita.
- d) Climate Livelihood and Production in Southwest Pacific Project looks at past present and future trends in production systems in particular the

sustainability or the collapse of production systems (CLIP Research Project 2007)

- e) Improve and/or strengthen the capacity of the meteorological services to produce early warnings and weather forecasts tailored for agriculture.
- f) Develop tolerant crop varieties and species – varieties that are tolerant to salt, drought, high rainfall and other effects of climate change must be identified, rapidly propagated and distributed to hot spots.
- g) Agriculture Rapid Response centres – set up a centre to prepare for disasters including pest and disease outbreaks.
- h) Weather forecasting – use better forecasting to predict outbreaks of pests and diseases. Set up weather stations at agricultural production areas – to ensure data critical to agricultural production such as rainfall, sunlight and temperate are collected and archived.

Climate change impacts on agriculture include rapid onset direct impacts such as those from extreme events (cyclones and floods) as well as slower impacts from temperature changes, salt-water intrusion and changing patterns of pests and diseases. Droughts, floods, storm surges, temperature changes, continuous heavy rain and prolonged cloud cover cause stress and shock to crops affecting production through soil leaching, erosion and low or destroyed yields. In addition during long periods of bad weather there is little agricultural activity leading to reduced production.

Climate impacts that lead to changes in agricultural production will have a major and direct impact on women because of their central role in agricultural production. Their work could be made much harder, leading to less time for other activities and potentially forcing them to seek other sources of income to be able to provide food for the family. There could be resulting social issues and health issues such as nutritional deficiency.

The specific impacts of climate change need further assessment with consideration of specific crops and local conditions. Some specific impacts of concern are:

- a) Increased intensity/frequency of cyclones can have dramatic effects on agriculture and food production that often lasts for many years. Also after the immediate effects, pests and diseases can come in later damaging the newly grow crops. Damage can be to subsistence as well as commercial agriculture. Food gardens can be damaged or destroyed and the force of a cyclone can snap or up-root coconuts, cocoa, fruit trees and oil palms. For

example, Cyclone Namu in 1986 had dramatic effects on commercial agriculture (palm oil and rice) in Solomon Islands and particularly rice production has not recovered and there is now a heavy reliance on imported rice.

- b) Pests and diseases multiply to destructive populations in accordance with temperature and humidity, potentially affecting important crops such as rice.
- c) Storm surges and flooding especially on low-lying areas can wash away food crops and cause water-logging of soil in some parts of the country. It can also destroy food stock for livestock as well as the direct loss of stock. These effects are exacerbated by continuous cultivation resulting in increased exposure of the soil to wind and rain.
- d) Salt-water intrusion, storm surge and flooding in low-lying coastal areas of the main islands and the atolls such as Ontong Java are already threatening food crops and livelihoods.
- e) Sea Level Rise and Coastal Erosion is becoming more evident, reducing the area of land available for agriculture either directly through loss of agricultural land or indirectly due to families moving further from the coast and taking up agricultural land. This erosion also increases vulnerability of agricultural land to rapid onset disasters such as cyclones and storm surges due to the reduction in the natural barrier functions from changes in coastal profiles. It also causes salination of the groundwater of particular concern to atoll islands such as Ontong Java.
- f) Increased temperatures - A correlation has been found between rising temperatures and decreased yields of taro on the coastal lowlands of Makira (Legu 2006). Fires can also result from burning of debris in shifting agriculture systems.
- g) Drought in different localised parts of the country, as influenced by El Nino and La Nina with impacts on food production.

### 2.3.2 Water Resources

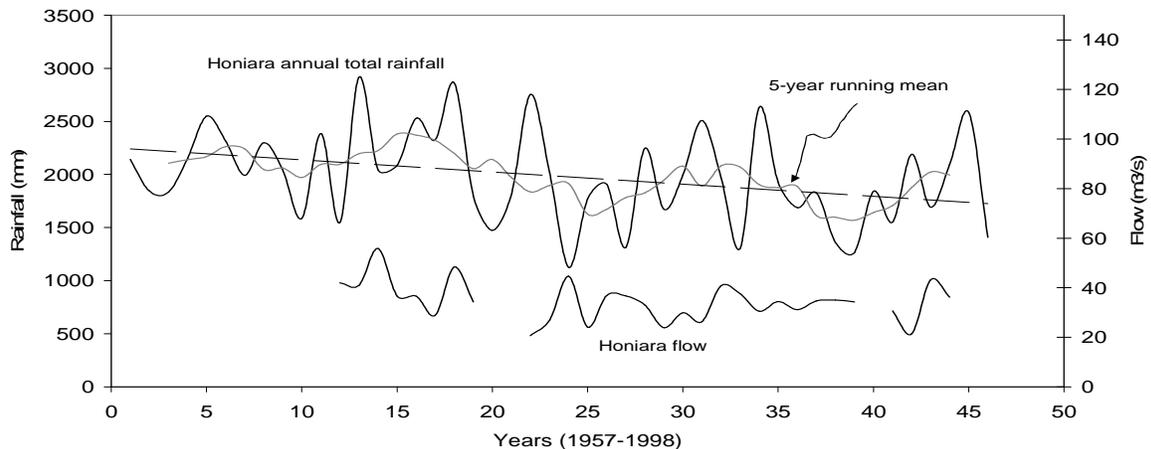
The Ministry of Mines and Energy has overall responsibility for water resource management however there are many other government agencies who are involved in water sector. With respect to water resources the priority of the government is to provide safe and reliable water supplies to rural and urban communities; although there has been limited attention on water management

and infrastructure rehabilitation for water and wastewater. Activities in the water resources sector range from water resource assessment, management to development. Each Ministry has its own plans and programmes to implement, and the government in accordance with their requirements of each Ministry coordinates these.

The overall objective of the Water Resources Programme is ‘to apply hydrology to meet the needs of sustainable development and use of water and related resources, mitigate water related disasters and ensure effective environmental management’.

Under existing programmes in the water sector, specific projects could be identified, which would provide opportunity to address climate change, and climate related extremes. Water resource managers should start addressing current stresses on water supplies and build flexibility and robustness into the system in anticipation of climate change. With this approach to planning, water resource managers will be better able to adapt to the future impacts of climate change, and will also be better equipped for the climate variability we are now experiencing in the country.

Planning and management of water resources in Solomon Islands to address climate variability and change can be facilitated through existing Government planning mechanisms. These mechanisms are currently adopted and practiced as part of Government planning programs and mechanisms and are very important in the implementation of Government policies and plans.



**Figure 7: General trend for rainfall and river flow for Honiara station**

A variety of climate change adaptation efforts may be undertaken that link immediate concerns to long-term development goals. These include:

- a) Improving water management and water use efficiency to reduce vulnerability to water shortages;
- b) Encouraging agricultural and land management practices that improve productivity and protect soil and water resources;
- c) Engaging in forest management and watershed protection to improve yields, provide habitat and reduce flood hazard; and
- d) The implementation of programmes and projects to enhance capacity building at the national level with functions related to water resources sector.

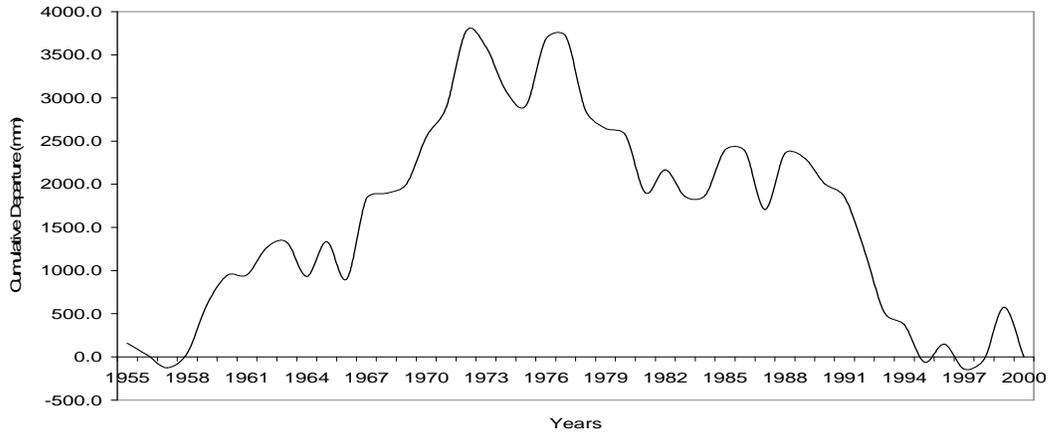
In Solomon Islands the capacity development needs for effective water resources management can be related to the removal of key Integrated Water Resources Management barriers (IWRM). They are identified according to the six (6) thematic areas of the Pacific Regional Action Plan for water management and its linkage to other sectors. The linkage to climate change needs to be incorporated into IWRM approach to water resources management.

There is evidence that water quality and quantity in Solomon Islands is reducing but the rate of reduction is not well understood due to lack of data and limited understanding of local hydrological systems and water resources. Simple hydrometeorological data analyses suggested that there was a decreasing trend for annual rainfall and water yield for Honiara, which means that Honiara City receives less annual rainfall with the reduced water yield now (Fig. 6).



**Picture 2: Water Quality in the low lying Islands - Rawaki, Western Province**

The second illustration (Fig. 7) indicated successive wet (upward trend) and dry (downward trend) years for Honiara City. Successive dry years can be seen as drought in Honiara City. The trend shows that there are already periods of water stress in the country regardless of future climate change.



**Figure 8: "Wet" and "dry" Years for Honiara Station.**

Water resource variability and vulnerability are major concerns throughout the country as a result of changing weather patterns, which may be linked to climate change. Villages throughout the country have experienced:

- a) Rising sea levels /coastal erosion causes damage to water supply infrastructure and saltwater intrusion into groundwater lens on low-lying and atoll islands.
- b) Water shortages can result in water supply shortages and shallow soils can be affected by relatively short periods of below average rainfall. Loss of moisture also affects food production. Water supplies were compromised severely during 1997/1998 drought in Honiara by 30-40%. Drought has also been felt for the first time in Reef Islands, Temotu Province. Floods can also result in damage to crops, infrastructure, loss of life and pose serious health risks. Damage to water infrastructure could undermine the quality and quantity of water.
- c) Saltwater intrusion into crops and planting fields can affect crops and food production. Saltwater intrusion on small low-lying atolls contaminates potable water from fresh water aquifers or lens.

These impacts mean that all the islands – whether they are atolls, artificial or mountainous – must try to cope with the changing climate and its impacts on water resources. Changes to the quality and quantity of water will have a large

impact on women and girls and their safety and security if they need to travel further to collect water, also leading to less time for other activities.

### 2.3.3 Human Health

Ministry of Health and Medical Services (MHMS) is the lead agency for health in Solomon Islands. Its vision is for “a healthy, happy and productive Solomon Islands People” and its missions is “promoting, protecting and maintaining the good health and well being and hence improve the quality of life of all people in Solomon Islands” .

The overall policy framework emphasizes working with partners (many of whom are working in climate change areas) and the work of the Ministry is to address issues already that will be affected by climate change. For the MHMS to work in the area directly, climate change must be incorporated into the National Health Policy and Strategic Plan 2006 - 2010.

Some divisions of the MHMS have developed plans and measures to respond to health issues in Solomon Islands and these could be adopted to respond to problems from climate change. However, the Ministry has not taken it seriously and yet to develop a specific plan. Fortunately, the diseases to be prevented by the MHMS are also those affected by climate change so these programs should be well targeted already, although they may need to be strengthened and expanded to new areas depending on prevalence.

- a) Solomon Islands Training and Research Institute (SIMTRI) has developed a manual on climate and malaria incidences to assist supervisors in the field to plan their operations in line with weather patterns.
- b) Community training is a feature of some health projects such as community based first aid training offered across the country by Solomon Islands Red Cross. Disease prevention, water supply and sanitation construction and maintenance are also features.

There is very limited understanding or awareness of climate change within the health sector so there is a need for education training and awareness-raising. SIMTRI provides training in public health for organisations and assist with research. Education and awareness-raising are major tools to respond to promote good health in communities. Some programmes use radio, give talks, provide training or use information, education and communication materials.

Health impacts from flooding and from climate change need further research and data to strengthen commitment to address the issues. Monitoring and

supervision is part of the activities of the health sector with some data systems effective and efficient and others needing greater improvement. Research is needed to better understand the links between incidence of vector-borne and water-borne diseases and climatic parameters such as rainfall and temperature.

In addition baseline data is needed to fully appreciate the impacts of climate change on health in Solomon Islands. This could use the Red Cross methodology of Vulnerability and Capacity Assessments to get a full picture from the village perspective of potential impacts. This would allow operational and strategic plans to predict disease outbreaks and reduce disease prevalence.

The MHMS does not have a climate change response strategy but the offices and agencies countrywide have systems and mechanisms that could be directed to focus on climate change impacts. This would strengthen cooperation amongst the agencies involved. For example the Health Promotion Division has a strategy that is used for threatening disease outbreaks that would be the same for climate change related disease impacts. This would be cheaper than running an additional centralized programme for rural areas that would require more staff and other amenities, as these are already needed.

SIMTRI could assist in developing a training course on the impacts and diseases affected by climate change. This would cover also research skills so others could do research and contribute data. Other agencies such as Ministry of Environment Conservation and Meteorology (MECM), National Disaster Management Office (NDMO) and WWF would need to be involved as well (link with SICHE curriculum on climate change). The following needs have been identified:

- a) Develop a data bank of data related to climate change and health – must be timely to ensure timely response such as the above early warning system
- b) Align data systems that exist with meteorological data
- c) Mapping of direct and indirect health impacts from climate change would support better planning
- d) An early warning system would enhance timely interventions for disease control that is site specific and takes into account local climate and health relationships and local cultural factors.
- e) Development of materials, guides, handbooks that would help students and health workers in predicting disease outbreaks, preparing and implementing emergency response and raising awareness.

In Solomon Islands specific diseases have been linked to climate and or weather patterns including malaria, mental illness, malnutrition, diarrhoea, acute respiratory infections, micronutrient deficiency, parasitic diseases due to poor sanitation, tuberculosis, leprosy and non-communicable diseases. Climate change will also adversely affect water and sanitation, food shortages leading to poor nutrition, reduced immunity and enhanced distribution of bacteria and parasites. Increased rainfall and increased humidity leads to more breeding sites for malaria mosquito's survival and transmission. From a household perspective, such changes to health and diseases place additional burden on women and children.

Overall health impacts from climate change are not well understood in a Solomon Islands context and more research and data collection is needed to plan, prepare and build commitment to the issues across stakeholders. Health issues cut across water and sanitation, agriculture and fisheries. Whilst there is not a specific climate change and health policy or framework in place it is recognised that with adequate support the existing mechanisms and work areas of the MHMS could be easily adapted to incorporate concerns about the health impacts of climate change.

#### 2.3.4 Human Settlements

The corporate Plan of the Ministry of Lands, Housing and Survey for 2008-2010 was prepared during a period of political transition and rebuilding against a backdrop of the set backs of recent years. The Solomon Islands Government (SIG) recognizes that land is a very sensitive cultural and identity issue and also something that is most basic to nation building and economic prosperity.

Effective land administration that delivers secure title to productive land in a timely and efficient manner is essential for economic recovery and growth in the Solomon Islands. Accordingly, the Government has given priority to developing the productive use of land through more secure title and its more efficient allocation and management. Steps are also being made to reduce conflict over customary land through the formal recording of ownership and mapping of their land boundaries.

Land tenure and ownership and title of rights to land has implications for dealing with and managing the effects of climate change and sea level rise on communities and/or villages. Securing land becomes a critical issue when considering relocation and resettlements schemes throughout the country. There have been previous activities of relocation within and outside of the country,

believed to have been the result of disasters, population pressures and probably climate change in a very minimal scale. Associated factors of water and agriculture difficulties have also contributed to the push and pull factors which resulted in people from island groups especially leaving their cultural and traditional home to settle elsewhere in the country. Such relocations can be seen in the Western, Guadalcanal, Temotu, Malaita and Choiseul Provinces as well as in Honiara.

Climate change and sea level rise is likely to displace a number of communities and/or villages. Of particular note is the limited potential for adaptation in low-lying atolls and artificially-built islands. These communities and/or villages often have very little or no land to move to and therefore are limited to living in high risk, disaster-prone and climate-sensitive environments. Thus the land tenure system in the country is one contributing factor to the settlement patterns and other risk and climate change issues in the country. Land owning groups within the local communities should be vested with certain powers to make decisions at the community, provincial and even national levels regarding the tenure systems.

Responding to the country's economic needs, the government has given priority to stimulating the economy is making productive land available for development with the necessary security to encourage development. This means bringing 87% of the total land area in the country held under customary tenure onto mainstreaming economic development by providing security of title for land owning groups under a new law that not only recognizes traditional institutions such as tribes and titles to customary lands, but places the administration of all customary land in the peoples' traditional legitimate institutions in collaboration with the provincial administrations.

Its success in achieving economic development depends on establishing an environment in which businesses have the confidence to invest, namely one in which there are transparent and secure property rights, efficient infrastructure, open capital markets and the rule of law is upheld by all players. This requires land dealings to be carried out in a manner that is fair, transparent and accountable so that potential investors can be guaranteed secure title to their lands. In addition, revenue collection is a major priority for the government. The revenue enhancement & generating task force identified major inefficiencies in public sector revenue collection and management mechanisms.

Lands, Physical Planning and sector members around the country need some information regarding likely impacts on this sector due to climate change and extreme events. Very little information is available to the various agencies within this sector.

Climate change impacts currently being experienced in the Solomon Islands include the following:

- a) The movement of communities and/or villages to areas that are easily accessible to food sources and water availability.
- b) Loss of soil moisture due to prolonged drought and loss of fertile land from river and coastal flooding.
- c) The coastal, low-lying and low-land inland settlements are affected by storm surge and river flooding. However, the low lying atolls and the artificially-built islands will be affected the most.
- d) People's properties, and land areas can be affected when severe storm surges start causing erosion to the coast lines.
- e) The coastal and island communities and/or villages sometimes do not have a choice of moving inland as they will be intruding into different tribal land areas.
- f) A lot of coastal communities have moved 2 to 3 times up land during the last 10 to 15 years, due to intrusion of high seas and storm surges. This impacts especially on the people living along the Weathercoasts of Guadalcanal, Makira and elsewhere in the country that faces out to the open ocean, and where there are no other islands to protect them.



**Picture 3: Impacts of Sea level rise and tropical cyclones on the low lying Islands - Lordhowe and Tikopia**

Although tropical cyclones often occur, the intensity is increasing and cause serious damage to villages and houses, land especially along the coastal areas, traditional and cultural settings, systems and way of living, the movement of human settlements due to this impact is such that it has and will impact negatively on this sector, and the timing to recover has been and will still be an issue in the country. A lot of people in the communities rely heavily on traditional early warning systems, especially those communities which are very remote. The underlying factor here is that western influences have actually

impacted on the transfer of this useful knowledge from generations to generations.

Other impacts include land loss and destruction of and/or loss of cultural heritage and traditional land marks. The low-lying atolls and artificially-built islands do not have direct access to lands on larger islands and therefore these groups will be seriously affected by sea-level rise. It will be necessary for these groups of people to be resettled but will require and depend entirely on national and provincial government efforts.

The geographical setting of many communities is usually along the coastal areas, which indicates more serious impacts with regard to cyclones, floods, sea-level rise and storm surges. The provision of infrastructures and service is also stimulated by the settlement pattern of our communities which poses a real threat to our national, provincial and local services.

The impacts of climate change and sea-level rise on human settlements pose serious questions regarding adaptation options. One of the key options will be through relocation and resettlement schemes. Thus, it will require legislative and structural changes to the land tenure and land management systems in the country to facilitate such actions. Climate change impacts must therefore be addressed or included when considering development potential and sectoral and regional planning.

### 2.3.5 Energy

Availability of affordable and sustainable energy is critical to the achievement of the Millennium Development Goals for Solomon Islands, as is the maintenance of environmental quality. As with most Pacific Islands Countries the majority of energy consumed in Solomon Islands is from biomass, mainly for cooking and drying coconut and cocoa for export. Accessible fuel wood is increasingly scarce due to over harvesting and in areas where mangroves are harvested for fuel there can be coastal erosion. People dependent on biomass for fuel often live a subsistence lifestyle and are reliant on transport by dugout canoe or outboard motor, and inter island shipping by diesel ferry.

Another energy source is imported petroleum such as petrol, diesel, oil and kerosene. About 95% of the electricity generated is from diesel generators or combusting other fuels. Road and marine transport consume over half the imported fuel and produce a lot of greenhouse gases. Access to electricity is highly varied across the country. Transport and electricity generation

(residential, commercial and industrial) are the major sources of greenhouse gas emissions in Solomon Islands.

The National Energy Policy Framework sets out the Government's policies for planning and management of the energy sector for the next 10 years. It is mindful of the role of energy in socio-economic development and also of the environmental impacts. It highlights three important areas: supply; utilization; and environment.

The vision statement of the Energy Division of the Ministry of Mines, Energy and Rural Electrification (MMERE) is "to facilitate adequate, reliable, safe and affordable supply of energy to urban and rural Solomon Islands". Its mission is "to develop and manage the living and non-living resources of Solomon Islands for the social and economic benefit, advancement and well being of the people now and for the future." To do this, it operates within a legislative framework with regulations and Acts of Parliament.

Energy production, utilization, conversion and transportation has and will be affected by most natural weather phenomena such as droughts, floods, fires, storm surge, cyclone and ENSO:

- a) **Droughts** - energy from hydropower relies on rainfall and reduced river flow over a period of time could reduce or disrupt entirely energy generation. Biofuel production from copra could be affected due to reduced productivity of the coconut plantations. Increase cooling in premises due to sustained dry and sunny periods could result in increased incidences of power outages due to lack of supply, and also the need to import greater amounts of fuel.
- b) **Flooding** of riverbanks could adversely affect stream flow particularly where hydropower is generated. Flooding and associated cloud cover will affect photo-voltaic (PV) generation and wind power.
- c) **Fires** - The location and severity of fires will determine the impacts on the energy sector as it may affect forests that are a source of biomass or coconut plantations
- d) **Storm surge** - Storm surge can affect sea, land and air transportation and cause disruption of fuel distribution. Impacts on renewable energy technologies will depend on the magnitude and their location in relation to the storm surge.
- e) **Tropical cyclones** - Cyclones have a similar scenario to storm surge except that the detrimental effects could be on a larger scale.
- f) **ENSO** - Consequence in an El Nino year will be similar for drought conditions

- g) **Health** - Health services rely on energy supplies to operate vital equipment so disruptions to energy will adversely affect health services and therefore health outcomes for the community.

### 2.3.6 Fisheries and Marine Resources

The Solomon Islands marine fishery is one of the country's most important resources characterized by a highly significant subsistence fishing and industrial tuna fishery. Up to 90% of the Solomon Islands population<sup>6</sup> dwell in rural areas, so subsistence and artisanal fishing activities are widespread and of great importance to their livelihood. Fishing provides a critical source of food for communities and a boost to local economies. These fisheries are mostly in coastal and inshore reefs and lagoons. They involve both capture and aquaculture. The target resources are small pelagic fish, bêche-de-mer, trochus, giant clam, coral, lobster, and aquarium fish.

There are few full-time commercial fishers. Those in full time employment often live in urban centres and do not have other agricultural opportunities and rely on the sale of fish to generate an income. The role of woman and children in fisheries is usually in the collection of shellfish for daily consumption or harvesting coral and seaweed.

Transport costs and logistical difficulties (infrastructure, electricity, and remoteness) are major constraints to sector development in both community based and industrial fisheries. The negative side however is felt most keenly at the community level where the proximity and promise of the inshore fishery has constantly raised expectations but rarely produced an anticipated outcome.

It is estimated that by 2010, the population of the Solomon Islands will be approximately 550,000 and the national need for fish for food is estimated to be 10,000 tonnes per annum. An estimated 20,000 people are also expected to be seeking some level of income from the sale of fisheries products by 2010<sup>7</sup>. It is therefore a highly significant resource for the future for the country.

### **Tuna**

Tuna, especially skipjack, has always been a culturally significant, highly valued and nutritionally important fish in the Solomon Islands. It is currently the only

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<sup>6</sup> The 2005/06 Household Income and Expenditure Survey (HIES) gives the total population of the Solomon Islands as 533,672.

<sup>7</sup> 2002 Solomon Islands Government Aquaculture Plan 2002 - 2006

form of industrial fishing and in 2004 accounted for approximately 14%<sup>8</sup> of the GDP. In 2007 the industry was made up of 11 entities<sup>9</sup> that used long-line or purse seine fishing techniques. Catches are dominated by skipjack, with yellow fin and big eye making up the balance. Most fishing for tuna takes place north of Honiara towards the equator and near Noro, Western Province.

In the period 2002 – 2007 the annual catch estimates of the Solomon Islands fleet have generally increased as did the fishing effort (sets) and (number of fish per 100 hooks). In the purse seiner fleet total catches have increased from 6,782 metric tonne (mt) to 22,313 mt in 2006, comprising 60% skipjack, 39% yellow fin and 1 % big-eye. In 2007, the catches dropped to 17,306 mt due to change in fleet size and other issues faced by fishing companies. The 2006 provisional data show that catches of all major tuna species have increased to over 13,388 mt of skipjack, 8,256 mt yellow fin and 669 mt of big-eye harvested.

The foregoing indicates that as an economic activity and a revenue-earner tuna fishery is highly significant to the economy of Solomon Islands. Any adverse effect on tuna fishery resource resulting from climate change will lead to loss of revenue, jobs, livelihoods, social disruption and economic decline.

The coral reefs on the shores of the double archipelagic chain of steep, mountainous and mostly volcanic islands of Solomon Islands are mainly narrow, fringing and intermittently distributed. Their collective area is large because of the particularly long coastline of the 1000 islands. Long barrier reefs and expansive intertidal reef flats are uncommon; and Ontong Java, a northern outlier, is the only large atoll (70 by 11-36 km). The largest coral reefs usually occur where large lagoons are protected by raised or semi-submerged barrier reefs or by raised limestone islands e.g. Marovo and Roviana Lagoons and Marau Sound.

The Solomon Islands has one of the highest diversities of corals anywhere in the world as evidenced by a record of 494 species in a survey conducted by the Nature Conservancy and the Solomon Islands Government. Nine of the species were unknown to the coral experts, which may be new species. Of the described species, 122 species have their known ranges extended and also confirmed that the Solomon Islands possess one of the richest concentrations of reef fishes in the world. A total of 1019 fish species were recorded, of which 786 were observed during the survey and the rest were found from museum collections. A formula for predicting the total reef fish fauna indicates that at least 1,159 species can be

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<sup>8</sup> Government estimate from DEVFISH 2006 (Fishing Association and Fishing Industry Data)

<sup>9</sup> Solomon Islands Government, Japanese, Americans, New Zealand, Koreans, European Union, National Fisheries Development (NFD), Republic of China, FSM Arrangement vessels, two small domestic companies (Global and Marko)

expected to occur in Solomon Islands. Forty-seven new distributional records were obtained, including at least one new species of cardinal fish. The number of species visually surveyed at each site ranged from 100 to 279, with an average of 184.7. Two hundred or more species per site is considered the benchmark for an excellent fish count, and this figure was achieved at 37 percent of the sites in the Solomon Islands. One site (Njari Island, Gizo) was the fourth highest fish count ever recorded for a single dive, surpassed only by three sites in the Raja Ampat Islands in Indonesia.

Sea grass biodiversity is also high with 10 species of sea grass representing 80% of the known sea grass species in the Indo-Pacific Region. The most extensive sea grass meadows were found in Malaita Province, where there were some very large meadows, including one that was more than 1000 hectares in size. Sea grass meadows were associated with a high biodiversity of fauna including dugong, fish, sea cucumbers, sea stars, algae and coral. These highly productive sea grass meadows are often located on the fringe of coastal communities and support important fisheries and provide extensive nursery areas for juvenile fish.

A relatively low species diversity and abundance of cetaceans (whales and dolphins) was recorded throughout most of the Solomon Islands with spinner and spotted dolphins locally abundant in some areas. Ten species of cetaceans were sighted, including spinner, pantropical spotted, Risso's, common bottlenose, Indo-Pacific bottlenose and rough-toothed dolphins, a Bryde's or Sei whale, orca and beaked whales. Sperm whales were also identified acoustically.

There has been recent coral bleaching, coincident with higher than usual sea temperatures. There is also historical evidence of periodic tectonic uplift during earthquakes and of sediment from volcanic activity burying reefs. Apart from these, the biggest threat is the coincidence of rapid population growth, high unemployment and relatively new opportunities to generate cash such as selling reef fish for restaurants and fish and corals for aquaria. Without alternative opportunities for cash income, the more lucrative reef species will be depleted, and alternatives are scarce.

Prevalent widespread logging results in huge plumes of sediment discharging from the rivers and causing major impacts on lagoons and coral reefs. A good example is southern Marovo Lagoon, an area also affected by plans for oil palm plantations on cleared unstable hill country thereby creating increased sediment flows. However the potential effects of sedimentation are not being monitored nor are the effects of other types of pollution near Honiara (readily visible from the air) and from other industrial developments such as oil palm extraction and fish canneries. Gold mining on Guadalcanal, and proposals to mine gold and nickel in New Georgia could also potentially degrade coral reefs.

The Ministry of Fisheries and Marine Resources (MFMR) mandate is in part derived from the Coalition for National Unity and Rural Advancement Government (CNURA) policy document prepared in January 2008. The document sets out the Government's priorities with the expectation that these should be translated into the appropriate work programs and projects. For Fisheries the policy framework states:

- a) Increased opportunities for rural fishers to improve their standard of living by establishing on-shore fish processing facilities and the introduction of pump-boats.
- b) Establishment of a dolphin assessment and monitoring program
- c) Increased potential value of fisheries and marine products by setting up two tuna loin processing plants in the country.
- d) Strengthen Soltai fishing and processing company to ensure its long term survival economic viability.
- e) Improve Solomon Islands earnings through the realization of the international value of the resource and effective licensing procedures.
- f) Management plans and appropriate legislations are in place for the main stocks.
- g) Monitoring systems are in place that provides accurate and timely information on commercial and sustainable fisheries for all stakeholders including regional agencies.
- h) Enhanced organizational capacity, systems, and skills to support MFMR meet its commitments.
- i) marine products by small-scale fishermen or fishing communities so as to allow them to actively participate in in-shore fisheries activities

As yet, very little scientific work has been carried out on the coral reefs of Solomon Islands. There is an urgent need to describe, quantify and catalogue the biota of the reefs, especially for baseline studies of potential impacts, and to undertake near-shore oceanographic research. Reliable statistics on the quantities of various reef species eaten and exported are also needed.

Periodic natural disasters such as ash showers from volcanoes, tectonic uplift, tidal waves and cyclones, damage coral reefs in Solomon Islands. Powerful earthquakes (e.g. in 1931, 1939, 1950, and 1952-56) uplifted coral reefs by as much as a metre resulting in large dead areas of coral.

Cyclones can devastate reefs, especially when they hit areas where wave action is usually slight. Unusually low tides coinciding with high air temperatures can damage corals e.g. in 1983 and 1997/1998, many coral reef flats died because of a lowering of sea level in the southwest Pacific during the strong El Niño event. Protracted periods of low seawater salinity from excessive rainfall damages corals inside lagoons.

Information about coral bleaching in the Solomon Islands is scarce. It is possible that the dead and dying corals observed by Morton and others on the British Royal Society Expedition in 1965 may have been from coral bleaching. There was extensive coral bleaching in many parts of the Solomon Islands in January to May, 2000, coincident with serious bleaching in Fiji. Observations at two reefs near Ghizo revealed extensive bleaching of plate and staghorn (*Acropora*) corals and some anemones. Bleaching was bad in parts of the Florida Islands with corals on the outside of the reef rather than those inside the lagoon being worst affected (Franck Boulay, manager of *Solomon Sports Diving*, Honiara). *Bilikiki Cruises Ltd.* operate dive excursions to 20 sites report that most coral reefs in May 2000 have had about 20% of corals bleached with some of the shallow sites exhibiting bleaching as high as 50%. There are also reports of bleaching from Otong Java (Lam *pers. obs.*) and on reefs of Fuaga island in Malaita (Boeni *pers. comm.*).

The water temperature for *Bilikiki Cruises* sites were on average 26°C in 1998, and from January to March 2000 increased to 30°C. From September to December 1999 mean monthly sea temperatures at Honiara were between 29.5 and 30.0°C.

Damage to coral reefs by the starfish, *Acanthaster planci*, is sporadic in the Solomon Islands. Most sites in Western Province show minor damage, though in Sandfly Passage, Tulagi and Gavutu in the Florida Islands there has recently been considerable damage attributed to the crown-of-thorns starfish. Occasionally major outbreaks have been reported at Mamara just west of Honiara.

### 2.3.7 Mining

Mineral exploration in Solomon Islands started in the late 1800s but serious exploration only picked up after the World War II. Exploration continues today on most of the large islands. Mining and extractive industries are currently at low levels.

Mining operations commenced operation on Guadalcanal by Gold Ridge Mining Limited (GRML) in 1999 but closed after three years due to the civil conflict. It uses open pit mining methods. During its operation the landowners received a comprehensive package to compensate for the impacts of the mine including infrastructure, financial benefits and employment. There were also benefits to the government through royalties and taxes. During operation the mine contributed 30% of the GDP.

There are many threats to the mining industry from climate change. Impacts from flooding and storms are the main concern along with their associated impacts on water resources. The open pit mining method used by GRML is likely to be used by any future mining projects. Climate impacts may result in a review of the integrity and viability of specific initiatives but the full nature of the impacts and risks, and the ability of the mining sector to adapt, as yet remains unknown.

Flooding, associated with tropical cyclones or with heavy rainfall events, could cause disruption to activities within the pit meaning high costs would be incurred to dewater the pit, containing sediment and loss of production.

Sediment loss is directly related to the erosion of the site and this would be exacerbated by intense rainfall. Sediment loss has the potential to lower the biological productivity of the affected aquatic environment, produce negative aesthetic impacts and reduce water quality for human use. Waste rocks are potentially acid forming and rainfall leaching of this high calcium waste tends to produce a leachate that is unacceptably high in arsenic. High rainfall may increase generation of leachate.

Severe flooding and tropical cyclones can damage infrastructure such as roads and bridges, as well as tailing dams and ponds leading to them over topping resulting in the discharge of hazardous chemicals. Such disasters can inflate the company's costs due to compensation and remedial measures. It would also act as a deterrent to other mineral developments in the country and make other landowners develop a negative perception of mining. Tropical cyclones may also affect the risks and opportunities posed by deep-sea mining.

Higher temperatures and increased drought conditions are likely to affect worker productivity. Dust and air pollution increase in periods of drought that may become a health hazard for workers and surrounding villages. Drought and higher temperatures are likely to result in increased demand for cooling on site and the associated energy costs will increase.

Higher temperatures resulting in a greater loss of water through evaporation, especially in limestone areas, will exacerbate localised drought conditions and cause a further decline in soil fertility. The runoff following rainfall periods will leach the soil and potentially favour increased agricultural pests and diseases affecting site rehabilitation.

Reduced water availability may result in shortages for communities downstream or at the mine site itself. Most mines such as GRML also use bore water, which can be expensive. Fire risk can increase in periods of drought, which can damage

storage facilities, machineries and natural environment. Storm surge and sea level rise may affect beach sand and aggregate mining.

Understanding risk exposure in the future is important but not well understood in practical terms within the mining sector in Solomon Islands. More detailed mapping and scenario planning is needed including the sensitivity of the local workforce, temperatures that are optimal for production, availability of materials in the global market. Such research should also consider the economics of adaptation versus the costs of a cleanup.

The sector wide response has to focus on mainstreaming climate change into policies and programming in the mining sector with the aim of enhancing the resilience of the industry to the impacts of climate change. Such research should cover:

- a) Characterizing how the mining sector in Solomon Islands is sensitive to climate change and assess perceptions among different operators.
- b) Survey industry experience and perspective on the risks and opportunities of climate change.
- c) Document strategies to adapt with impacts on mining operations and their application across the country.

Those with long term interests – government, regional development agencies, insurance companies, pension funds etc. – should take a lead in advising industry and business. However, the government cannot protect the industry from all impacts and like other industries the mining sector has to understand the impacts, assess their activities and potential vulnerabilities in order to prepare and adapt to climate change. The government should, though, provide leadership and give a strong signal to make adaptation more viable economically such as through tax relief for such measures. The cumulative actions by business government and individuals will increase the preparedness of the country to future climate impacts.

Climate proofing of mining ventures will require practical strategies based on sound data. Some first steps are: to understand the projected changes over the lifetime of mining activities and assess the vulnerability of activities to climate change; assess the company's adaptive capacity and prioritise actions; integrate adaptation to all aspect of the business. Some specific areas of concern are:

- a) Sediment loss during heavy rainfall period is difficult to control but limiting the disturbance of the ground during these periods is important.

Future mine design should include plans for intensity and timing of rainfall event in the future with climate change.

- b) High rainfall also needs to be considered when planning tailings water management and settling densities. To do this kind of planning mapping is needed to reveal sedimentary basins as well as mineral types. This would also assist in carbon sequestration projects if these are undertaken here to reduce carbon emissions.

### 2.3.8 Infrastructure Development

The government's policy statement sets a single National Objective for all infrastructure development is to "Rehabilitate damaged social and economical infrastructure as building new ones to stimulate economic growth especially in rural areas." Infrastructure development, whether new or rehabilitation, is not an end to itself but a means to economic development, giving priority to rural areas. Sectoral objectives are set to serve this national objective and choices of infrastructure programmes and activities must be specifically aligned towards wider rural economic development. Addressing sectoral objectives is not sufficient enough; activities must also address the National Objectives of economic development. To emphasize the "out of sector" objective for infrastructure development the national level outcome indicators have been set in terms of human development and increased economic activity in rural areas.

Some on-going projects have been designed to address narrower, purely sectoral objectives which do not deliberately address economic development needs. Donors have commenced the process of adjusting such activities to increase congruence with Government policies - consistent with the Rome and Paris Declarations on harmonization and aid effectiveness. Such a review process is needed in all on-going infrastructure programmes to promote congruence and optimize the benefit of donor and government. Development of new programmes and plans must also look beyond sectoral concerns to their contribution to economic growth.

Reliable and efficient land transport is essential for both the service delivery and the market access upon which social and economic development depends. However, the extremely poor condition of rural roads makes it difficult or impossible to move people and commodities to markets and services. Three strategies are proposed to correct this situation. First, government's highest priority for rehabilitation of damaged infrastructure will be implemented through rehabilitation of high-priority roads in rural areas throughout the country; second, to stimulate economic development, new roads and bridges will

be built in support of the focus on rural development, including development of Malaita and Guadalcanal road networks and third, the strong focus on poverty reduction will be made by adoption of a strategy to increase use of labour-based construction and maintenance methods and integration with other rural transport service.

Inter-island transport is required to connect producers to domestic and international markets, enable labour mobility, facilitate access to social services, all of which are essential components of the overall poverty reduction strategy. Inter-island shipping also serves the national objective as stated above while it also serves to sustain effective operations and services in the long term and to continue the rehabilitation and improvement of maritime infrastructure.

Civil aviation includes both domestic and international transport services and is the principle means of international passenger travel and preferred mode for tourists inter-island travel. As such, civil aviation has a lesser contribution to the national Objective of rehabilitation but a distinct role in terms of the international dimensions of economic development and especially of tourism development-where present civil aviation services are identified as a major constraint on development.



**Picture 4: Coastal Erosion impacting on infrastructure - Fera airport, Isabel Province**

Reliable and reasonably priced telecommunication services are vital for social and economic development as well as public safety and security. All commercial activities rely on voice and data communications by phone and increasingly, internet services to carry out their business and receive and place orders. The high costs, limited coverage and poor quality of telecommunications place all Solomon Islands commercial activities at a competitive disadvantage, especially the provincial and rural enterprises the Government wishes to promote.

Very little climate change-related education, training and public awareness is found in this sector apart from engineers designing bridges, wharves and roads

to accommodate weather and other variables like temperatures and rainfall. Engineers and those involved in designing and building infrastructures around the country need some information regarding likely impacts on these infrastructures due to climate change and extreme events. Very little information on climate change impacts is available to engineers designing and constructing the infrastructures around the country.

The following adverse impacts resulting from climate change are often experienced in the country in respect of infrastructure development:

- a) Flood will have great effect on this sector especially regarding roads and bridges. In some past incidents bridges and roads were washed away or damaged. The most affected areas are on Guadalcanal, Makira and Malaita.
- b) Storm surge is likely to have negative impacts on inter-island shipping sector. Currently most ships operating in the country were all bought as second hand ships and most are aging. For example, two old ships (Ramos III and Western Queen at Ranadi) were grounded due to storm surges.
- c) Tropical cyclones will adversely affect Inter-island shipping - ships and wharves will be destroyed, road transports, communications, civil aviation disrupted.
- d) Sea-level rise poses the greatest risk to wharves if not designed to accommodate the sea-level rise. Coastal roads can also be damaged by sea-level rise if no adaptation measure is considered.

Currently engineers are designing bridges and wharves to withstand extreme events caused by climate after experiences from the past, but there is no clear direction of taking future climate change impacts into account. Moreover, currently there are no national policies addressing impacts of climate change on infrastructure development. All infrastructure development projects require EIA while some risk factors (not necessarily on climate change-related issues) are included in the design and construction of bridges, roads, and wharves.

### 2.3.9 Education

Schools and other educational institutions and their physical infrastructure are vulnerable to the impacts of climate change as are the services they provide because they can be disrupted by severe weather or climate extremes. Shortage of water in schools will result in disruption and may result in schools closing down. In the 1997/1998 drought, water flow into the Honiara Water Supply Catchment was reduced substantially to 30-40% of water supply. As a

consequence of this, most school programmes in and around Honiara were disrupted.

Near shore schools are also vulnerable to storm surge and to impacts of tropical cyclones. They can cause damage to and loss of infrastructure, lack of supplies (food and other), disease outbreaks and poor access. Risky sea transport is also an issue in storms and cyclones and can result in disruption or suspension of classes. For example, Cyclone Zoe in 2002 resulted in the closure of a primary school in Tikopia for the rest of that year. Cyclone Namu that devastated Solomon Islands in 1986 resulted in schools being destroyed and children were sent home immediately from boarding schools. The relocation of Selwyn College from Ngalibiu area to Maravovo is a good example of a strategy to minimise impacts from such events on educational institutions.

Schools, institutions, youth and village communities have a key role to play in dissemination of awareness so therefore should be a target for capacity and awareness-raising. Women play a key role in education and awareness in the family and community. Training of curriculum officers to incorporate climate change issues into current syllabus is important for capacity-building and awareness-raising. Such opportunities are currently being reviewed so as to include climate change concerns. Teacher training on climate change issues and development of teaching manual on impacts of climate change for rural communities should also serve as an important medium for capacity-building and awareness-raising.

In disaster response activities, the communities and/or villages need to be involved in the decisions about rebuilding or relocating key infrastructure such as schools. Such response is usually going to be supported by the government or donor partners, who usually have trained and skilled personnel. Awareness and training at the community level is of high priority and is needed as well at the government and general public level.

Vulnerability of schools and educational infrastructure to climate change is imminent but is not well understood. Thus both formal and non formal education sector has a key role to play in building a response to impacts of climate change at all levels. Many stakeholders and NGOs currently offer various training and education programmes that could be expanded to include climate change issues and concerns.

### 2.3.10 Tourism

The largely unspoilt natural environment and strong cultural practices in Solomon Islands provide a comparative advantage in the tourism industry. Major tourist attractions so far have been scuba diving, sport fishing and World War II History. Tourism development has largely been centered around the capital Honiara and in the Gizo area of Western Province where most of the tourism infrastructure including resorts, roads and airports are concentrated on the coast.

The current Tourism Development Plan contends that, as a tourism destination, Solomon Islands cannot sustain tourism development on a large scale or mass tourism as it currently does not have the capacity to absorb the infrastructure, institutions and impacts on such development. Thus, the future of tourism development is in diverse, small to medium scale developments targeted at niche markets including:

- a) Interpretive war tours
- b) Nature sites on lagoons, rivers, waterfalls, caves and smaller islands
- c) Cultural tourism through festivals, village visits and village stays
- d) Eco-adventure activities such as kayaking, trekking, surfing and camping
- e) Special interest tourism such as anthropology (culture), ornithology (birds), volcanology (volcano) and speleology (caves)

However, tourism development so far has been mainly led by the private sector with marketing support and as a result legislation, regulation, policy and planning have not been well developed.

Key ecosystems offering certain tourism sporting activities and beach holiday facilities will be directly threatened by climate change and sea level rise. Thus the future success of tourism depends on the quality of the environment, and the development of land use policies that preserve and enhance the biophysical resources on which it depends.

Increase in extreme events such as cyclone, storm surge and drought, floods, fires will have impacts that are specific to each destination. Impacts will result in increased risks to visitors, private and public tourism related infrastructure and will change the investment risk profile for new projects.

Changes to personal health risks such as vector borne diseases and tropical aquatic infections will increase in some areas with an impact on the operators and visitors. Climate change will affect wide geographical areas, visitors and residents. Therefore all stakeholders must be engaged in the response in an

integrated way. There is a need for strong political will to develop tourism in a sustainable way in future and with an awareness and understanding of climate change issues in developing Solomon Islands as a tourism destination with diverse niche products. Some initiatives proposed by Ministry of Culture and Tourism for ecotourism development includes the incorporation of climate change adaptation.

### 2.3.11 Trade and Industry

Solomon Islands Trade and Industry Sector includes formal, semi-informal and informal enterprises. Formal enterprises are those that go through formal registration as companies, partnerships, sole proprietors or cooperatives. They may be multinationals, Joint ventures, national or family businesses. Semi-formal enterprises are usually enterprises in transition from the subsistence level to just first steps of commercialization. Often these enterprises are not registered as business but merely pay license to operate. The informal enterprises are those engaged in the agricultural, fisheries/marine and forestry production and some value-adding and other related services mainly in the rural areas as well as urban centres.

Service performance and sustainability of these enterprises range from the more stronger multi-nationals, joint ventures and commerce and trading enterprises that are owned by expatriates and well-established nationals to the very weak semi-formal and informal enterprises owned by nationals and rural dwellers.

The Collective Importance of the Solomon Islands Trade and Industry Sector is important to the nation's economy and wellbeing. The natural resources (agriculture, fisheries/marine, mining, timber, natural beauty and clean air) are the fuel and lubricant for Solomon Islands economy and welfare." Trade and Industry is vital to the growth and development of Solomon Islands as a nation in the following ways.

- a) Earning foreign receipts for the nation in international commodities trade.
- b) Provide needed services and products in commerce and industry.
- c) Provide employment and providence for Solomon Islanders.
- d) Encourage entrepreneurial development for nationals.
- e) Provide infrastructural facilities and services.
- f) Optimise returns from natural resources exploitation.
- g) Provide sustainable livelihood and income generation for rural resource owners to improve their quality of life.
- h) Provide bulk for reliable revenue for government accounts.

- i) Supplements additional services provided by the government to the people.

Impacts from climate change and sea-level rise to this sector will hinder the economic development of Solomon Islands and its people. Climate extremes such as drought, flood, sea level rise, cyclones and rising temperatures will exacerbate adverse impacts on the Trade and Industry Sector characterized by;

- a) Geographic locations on low-lying coastal areas.
- b) Variable financial capacities and susceptibility to bankruptcy should disasters occur.
- c) Poor mitigation measures and disaster preparedness.
- d) Intimacy of value-chain dependency as suppliers of raw commodities or products for export or value-adding.
- e) Relatively high impact intensity due to the small economies of scale as a nation

In particular the impacts of climate will have the following effects:

- a) Drought will cause low production, slow growth, default on domestic and export supply, credit and degradation of quality of products and threat of fires/loss of crops.
- b) Flood damage to agricultural crops, property and infrastructure, closure of business, default in payments, destroyed properties, facilities and degraded stock and inventory, temporary close of business, bankruptcy and heavy financial loss and unemployment.
- c) Increasing sea-surface temperatures will affect near-shore and pelagic fishery resources, increased frequency and intensity of cyclones, and defaults on export and domestic supply and loss of businesses.
- d) Tropical cyclones will seriously affect main sectors of the economy thereby reducing potential for growth and loss of revenue.

### 2.3.12 Forestry

The forest sector of Solomon Islands generates about 70% of foreign revenue. Logging is occurring at four to five times the sustainable yield, reaching 1,000,000 cubic meters in 2005. This generated \$86.6 million in revenue for the government in 2005 (CBSI 2006).

The Forest Resources and Timber Utilisation Act 1969 and its subsidiary legislations are the only legal tools available to the Ministry of Forests to manage

the country's timber resources whilst at the same time ensuring the environment is safeguarded. Other laws do provide support to the management of forests.

The current government's policy goal is for the 'sustainable harvesting of timber resources with fair returns for landowners and governing; replanting and management of logger over forests; and care of the environment including promotion of all protected areas.' It would seem that current Ministry for Forests policy formulation is influenced more by the economic implications of the national resource and its environmental impacts than on the obligations of Solomon Islands under various conventions.

One of the many factors inhibiting the implementation of many environmental projects is the lack of data or the lack of data sharing. The Ministry of Forests has not been able to set up properly organised information databases due to lack of expertise, technology and financial resources. Data and information is building up in Solomon Islands on relevant issues to forestry but the information is scattered in the different government, NGO, regional organisations and individuals. Sharing of existing data and information is needed.



**Picture 5: Forest cover in Solomon Islands**

In addition to the specific impacts from climate change on forests in Solomon Islands, the importance of forests in alleviating climate change is a matter of global concern as old growth trees and their soils are carbon sinks - soils in undisturbed tropical rainforests contain large amounts of carbon. Specific actions are:

- a) Current forestry activities must be followed by reforestation and afforestation.
- b) Develop policy frameworks to protect mature forests to maintain carbon sinks
- c) Utilise existing support projects to address climate change issues.

- d) Incorporate into the Forestry Licensing Procedures the requirement that is in the Environment Act for all timber enterprises to comply with requirements to obtain 'development consent'
- e) Develop a database on all environmental issues (past and present reports, studies and data) that are relevant to the Forest Sector
- f) Liaise with the Ministry of Education to provide scholarships to study forestry and climate change impacts
- g) Incorporate climate change into relevant forestry courses in the School of Natural Resources.

Forestry is the major component of foreign revenue but is only going to remain so for 4 to 5 years under current rates. Logging and forest clearing have two fold issues – loss of carbon sinks and exacerbating the impacts from climate change (such as from flooding, cyclones, storm surge). Changes in temperature and rainfall will affect forest productivity.

There is a lack of coordination and cooperation in the sector. Legislation and policy need to be reviewed as a matter of urgency which would provide opportunity for incorporating climate change issues and concerns.

### 2.3.13 Waste Management

The relationship between climate change and waste management has not received a lot of attention but with an increasing population, planned and unplanned development and poor infrastructure waste management problems are an issue of increasing concern with respect to climate change in Solomon Islands.

Honiara and the provincial towns have very old and rundown liquid waste networks which are poorly managed and it is having negative impacts in three major ways:

- a) Unplanned urban development close to rivers, as demonstrated by the situation of pollution in the Mataniko River in central Honiara that runs through residential areas. The lack of town planning control and demand for land has led to random development and little or no waste infrastructure. This situation and other similar cases of unmanaged waste result in significant solid and liquid waste pollution on the coasts and beaches around Honiara.
- b) The limited network of sewerage pipes in Honiara means that the shoreline pipes discharge at several locations along the beaches.

- c) The reliance on septic tanks and soak away systems are vulnerable close to the shore.

All of the factors above result in incidence of high amounts of coliform around Honiara waters and have serious impacts on health, coastal ecosystems and marine resources. Of particular note is the direct impacts of drought on health as result of shortages of water to manage liquid waste; and floods which result in additional solid and liquid waste being flushed out to the ocean or water systems. Slack waste management efforts exacerbate this; fires can affect waste treatment facilities and can result in waste and debris from fires polluting waterways; storm surge can result in near shore septic tanks being damaged resulting in serious pollution. Storm surge can result in waste from the coast being deposited inland or to coastal access routes; and tropical cyclones which can damage near shore septic tanks resulting in serious pollution. Storm surge can also result in an accumulation of debris and waste.

In recent years there have been a number of waste management initiatives by government, NGOs and the private sector. These have tended to be ad-hoc because of the lack of an overarching framework. Thus the main actions needed for waste management in Solomon Islands are, among others, to encourage the incorporation of waste management into the educational curriculum along with climate change and to undertake research into waste and climate change issues.

## CHAPTER 3. IDENTIFICATION OF KEY ADAPTATION NEEDS

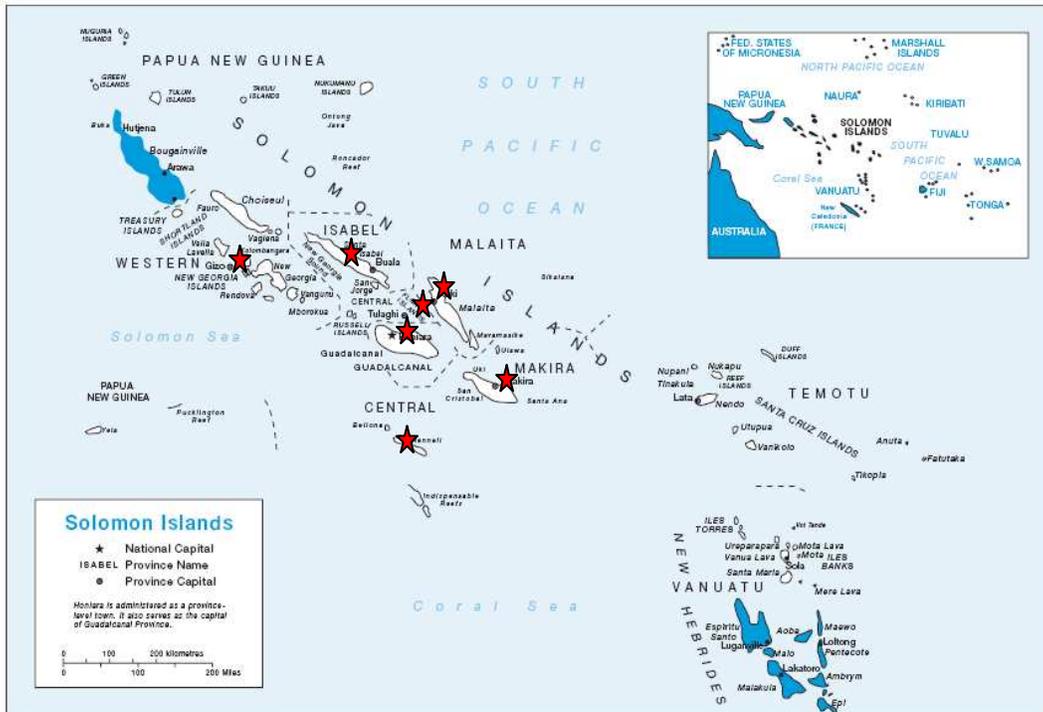
The overview provided in the foregoing chapter indicates that Solomon Islands will require a range of adaptation activities in the medium-term to cope with the adverse impacts of climate change and sea-level rise. These adaptation actions and activities will have to take place within the key sectors of the economy in order to enhance its adaptive capacity: agriculture, water resources, coastal zones, forests, mining, waste management, human health, energy, human settlements, trade and industry, tourism, fisheries, people and communities, and traditional cultures.

### *3.1 National Synthesis, National Communication and Other Documents*

Information on adaptation options were derived from sectoral reports, national synthesis of information on climate change vulnerability and adaptation issues, expert knowledge, scientific literature, national, regional and international research literature, government planning and policy documents, and the initial national communication and other multilateral environmental agreement reports. Information was then recast in the disaster risk reduction framework tool through a national workshop where adaptation options were discussed. In using risk assessment tool, it was possible to identify and highlight a range of adaptation activities/options within each sector with resource requirements, responsible agency, timeframes and expected outputs. The results of the risk assessment and adaptation options for each sector are outlined in the Annex 1.

### *3.2 Community Consultations*

In addition to the analysis and use of information from various sectoral reports, MEA reports, scientific, planning and policy documents, further information on adaptation options were identified through a consultative process involving various communities, islands and/or villages throughout the country. Consultations on climate change vulnerability and adaptation issues and options were carried out over a period of two weeks (from October 03 to 17 2008) in various provinces of the country by a team of 2-3 people led by a NAPA sectoral team leader. The following are the communities/villages that were consulted on their urgent and immediate needs for adaptation to climate change:



**Figure 9: Provinces covers during the Community Consultations**

In each community or village a total of approximately 30 people (on average) were consulted through focus group meetings led usually by a village Chief. Thus a total of between 1,000 to 3000 people were informed of the project and consulted on their needs for adaptation to climate change throughout the country. These people also represented 33 vulnerable communities and/or villages. In some cases, the communities and/or villages were visited twice; the first visit was to notify and inform appropriate authorities about the planned visit so that they would be prepared for the consultations which took place on the second visit, often on the second day. All consultation meetings proved to be quite successful as most of those involved were aware of the visit and had some prior knowledge of the issues relating to climate change and sea level rise. Often there were just as many women as men attended and participated in the discussions. The list of communities can be found in Annex 2.

The Consultation teams used face-to-face group sessions where possible or went house to house to meet with as many people as time allowed. They focused on getting input from all the people in the community - especially young people and women.

### 3.3 Guidelines for Community and/or Village Consultations

Provincial and community consultation is a key part of the development of the NAPA. Thus visits to several Provinces and communities and/or villages were carried out to discuss the results of the work on the NAPA so far and to get feedback, comments and to identify urgent and immediate adaptation needs. Before the community and/or village consultations were held a set of guidelines were developed and adopted by the NAPA Team to guide the consultations and meetings. Provincial Disaster Coordinators (PDC) at each Province were the main focal points for the visits.



Picture 6: Preparatory meeting for community consultations - NAPA Team

The guidelines were focused not only on the process of awareness raising and information sharing but also on the needs and concerns of communities and/or villages relating to adaptation to the adverse impacts of climate change. NAPA teams were advised to focus on the main issues relating to climate change vulnerability and adaptation covering all the key vulnerable sectors by:

- a) Introducing the project and main issues from climate change
- b) Explaining to the communities the purpose of the trip
- c) Giving an idea of the information that has already been collected (from the Synthesis Report and the Adaptation Options identified)
- d) Getting feedback and comments from them on the results

### 3.4 Outcomes of Community and/or Village Consultations

Consultations conducted reveal that adverse impacts of climate change and variability including extreme events are already being experienced in 33

communities and/or villages in seven Provinces<sup>10</sup> of the Solomon Islands. Most communities are aware that the changes they are experiencing result from the changes in rainfall patterns and seasonality. They have told stories of changes in yield of crops, cropping season, birds and plant species. They have also noticed that rainfalls at present seem to be more intense and continuous over long periods of time. Those who live on the coast observed that land is being lost through erosion and houses that used to be on land are now standing in water.



**Picture 7: Community Consultations - Guadalcanal, Western Provinces**

Some of the common impacts resulting from climate change and variability as observed and experienced by communities/villages include the following:

- a) Coastal erosion, extreme high tides
- b) Flooding – food crops, schools
- c) Changes in growing season
- d) Low productivity/yield of crops
- e) Frequent/continuous intense rainfall and sea storms (storminess)
- f) Incidence of pests attacking plants, e.g. slippery cabbage
- g) High incidence of malaria and water-borne diseases
- h) Landslides affecting food gardens
- i) Drought affecting water supply
- j) Sea-level rise – inundation of land and saltwater intrusion
- k) Rising lake level affecting food gardens as a result of continuous rain
- l) Loss of natural ecosystem resources – mangroves, coral reefs
- m) Absence of certain bird species – impact on pollination of fruit trees and others

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<sup>10</sup> Communities and/or villages in Choiseul and Temotu Provinces were not consulted due to logistical problems.

While these impacts may not seem unusual to the communities and/or villages the fact that they have become more frequent and in most cases intense means that traditional coping mechanisms may not necessarily be relevant. Some adaptation measures that have been carried out in most of the communities and/or villages include the following:

- a) Moving inland or to higher ground
- b) Building on stilts on water
- c) Use of water tanks - roof catchment
- d) Ground water
- e) Intercropping
- f) Coastal tree planting
- g) Seawall construction
- h) Propping up of houses in the water
- i) Building on stones - built up land
- j) Digging trenches to grow vegetables



**Picture 8: Low water mark -Lau Lagoon, Malaita Province**

While most communities are making every effort to deal with and cope with the changes resulting from climate change, variability and extreme events, there are some communities who have very limited opportunities for adaptation to climate change. These areas include Langalanga, Kwai, Ngongosila and Lau where most of the settlements are built on water. Others include the low-lying atolls of Ontong Java, Sikaiana, and Reef Islands. The settlements built on water depend almost entirely on rainwater and the supply of materials and resources such as mangrove for timber and firewood and sago palms for construction are in decline. In other low-lying atolls the vagaries of climate change and sea-level rise are putting additional pressure on limited resources.

The adverse impacts of climate change, climate variability and extreme events are manifested in the various changes that people experience and some adaptation efforts are already being undertaken as outlined above. However, many communities and/or villages have indicated that in order for them to better understand the adverse impacts of climate change and be able to make informed decisions about adaptation, it is vitally important the climate change education, awareness-raising and information dissemination becomes part of long-term adaptation effort in the Solomon Islands.

Most communities and/or villages depend on subsistence activities for their livelihood. However increasing demand for material goods and services in a modern growing economy makes cash income opportunities necessary. Thus any adaptation measure, option and strategy will necessarily include income-generating opportunities and the infrastructure to support such effort. For example, Solomon Islanders depend entirely on road and sea transport to move their produce to market. If heavy and intense rains and sea storminess continues as often as it is being experienced now the ability of people to move their produce to market is seriously compromised.

## CHAPTER 4. CRITERIA FOR SELECTING PRIORITY ACTIVITIES

Prioritization of adaptation needs can be done in a number of ways depending on national circumstances: cost effectiveness analysis; cost benefit analysis; and multi-criteria analysis (MCA). After much discussion about the merits and applicability of the various methods for prioritization it was agreed that multi-criteria analysis is the most appropriate method for prioritization of adaptation needs in Solomon Islands. The NAPA guidelines (as contained in the Annex to decision 28/CP.7) further require that a set of locally-driven criteria be used to select priority adaptation activities. These criteria should include, *inter alia*,

- a) Level or degree of adverse effects of climate change;
- b) Poverty reduction to enhance adaptive capacity;
- c) Synergy with other multilateral environmental agreements;
- d) Cost-effectiveness.

The above criteria should be applied to, *inter alia*,

- a) Loss of life and livelihood;
- b) Human health;
- c) Food security and agriculture;
- d) Water availability, quality and accessibility;
- e) Essential infrastructure;
- f) Cultural heritage;
- g) Biological diversity;
- h) Land-use management and forestry;
- i) Other environmental amenities;
- j) Coastal zones and associated loss of land.

A number of these criteria were used to prioritise adaptation options, measures, strategies, policies and activities. The first criteria relating to livelihoods relates not only to access to basic needs such as food, water, shelter, sanitation and health but also embraces the notion of fulfillment, empowerment and a sense of security for the community. The impact on economy is not entirely unrelated to the issue of livelihood, and includes economic/employment opportunities, as well as the importance of 'traditional' wealth measured in terms of family links and support, and ownership of pigs, gardens and other traditional items. The traditional family links are very strong, and is a source of support during times

of adversity. The added emphasis of the impact on environment and biodiversity underlines the special association of Solomon Islands culture and the environment which goes well beyond simple synergies with other multi-lateral environmental agreements. The adverse effects cover the vulnerability to hazards as measured by the number of people, ecosystems, areas affected and the consequent impact on the infrastructure, economies and on traditional practices.

#### *4.1 Country-driven Criteria*

In one of the workshops the NAPA team was tasked to develop country-driven criteria for selecting adaptation options and also to facilitate identification of vulnerable communities and/or villages where further consultations would be held. The following are the country-driven criteria used to select adaptation options and communities and/or villages for consultations;

- a) Severity of adverse effects and the underlying vulnerability
- b) Urgency
- c) Complementarity with existing projects, national development efforts, multilateral environmental agreements and sustainable development goals including poverty reduction.
- d) Culturally acceptable and owned by those affected
- e) Cost-effectiveness, feasibility and viability
- f) Increases community resilience to climate change and improves livelihoods and income generation
- g) Enhances adaptive capacity of communities and sectors to climate change
- h) Equity - gender and resources
- i) Sustainable in the long-term

Additionally, the adaptation options were selected by stakeholders and NAPA Team through several consultation workshops. The workshops carried out vulnerability analysis of the country upon which appropriate adaptation options were identified. These adaptation options were further discussed using the criteria outline above and the disaster risk management tool indicated in the previous chapter. The following list were selected:

- a) Agriculture and food security
- b) Water supply and sanitation
- c) Human Health
- d) Human settlements
- e) Fisheries and marine resources
- f) Coastal Protection

- g) Infrastructure
- h) Waste Management
- i) Tourism
- j) Education, awareness and information

## 4.2 Ranking of Adaptation Options

A multi-criteria analysis tool was applied to rank the prioritised adaptation options/sectors. A MCA tool is a decision-support tool which facilitates the selection and prioritization of complex or multiple problems/issues. In this exercise regular ranking was used to assign each element relevant to the decision process (in this case an adaptation option/sector) a 'rank' depending on its perceived importance. Ranks were assigned according to the following five-point scale:

1. *Weakly* important
2. *Less* important
3. *Moderately* important
4. *More* important
5. *Extremely* important

A total of 16 members of the NAPA Team were each tasked to conduct ranking and rating of the prioritised adaptation options. To simplify the process the 16 members were divided into two groups of 8 persons to carry out the ranking exercise. Apart from ranking exercise each group was asked to give each adaptation option a rating or percentage score between 0 and 100. After tabulating all the results of the group work further calculations were made as shown in the table below (Table 2) the following ranking was derived in order of importance. The combined weight of ranking and rating indicate that the most urgent and immediate need for climate change adaptation in Solomon Islands should be focused on agriculture and food security followed by water resources; education, awareness and information; human settlements; human health; waste management; coastal zones; fisheries and marine resources; infrastructure; and tourism.

With respect to preparation of project profiles further discussion was held to determine which of these priorities would be further developed as project profiles. The discussions also centered on the number of planned and existing projects that have been implemented in the various sectors. It was noted that a large number of projects and programmes are either currently being planned or have been implemented in the country addressing issues relating to agriculture and food security.

The priority sectors were then considered in order of their importance in a national workshop to review the draft NAPA document. In considering the number of project profiles to be developed four options were considered;

**Table 2: Calculating ranking and rating**

Options	Rank (a) (Gr. 1)	Rating (b) (Gr.1)	Rank (c) (Gr. 2)	Rating (d) (Gr. 2)	Calculation (e) = (a)+(c)	Calculation Rel.wt. (rank)	Calculation (Sum rating)	Calculation (Rel. wt.) (rate)	Combined Weight
Agriculture and Food Security	5	15	5	15	10	14.71	30	15.0	14.80
Water	5	15	4	14	9	13.23	29	14.5	13.86
Human settlements	5	15	3	11	8	11.76	26	13.0	12.38
Human Health	5	15	3	10	8	11.76	25	12.5	12.13
Fisheries/Marine	3	5	2	10	5	7.35	15	7.5	07.42
Coastal	3	7	2	10	5	7.35	17	8.5	07.92
Infrastructure	2	3	2	10	4	5.88	13	6.5	06.19
Waste Management	4	9	2	6	6	8.82	15	7.5	08.16
Tourism	1	1	2	6	3	4.41	7	3.5	04.00
Education, awareness and Information	5	15	5	8	10	14.71	23	11.5	13.10
Total		100		100	68	100.00	200	100.0	100.0

1. One project profile for five highly ranked (importance factor of >10) priorities, second for low-lying, third for others (i.e. 3 project profiles).
2. One for five ranked/top priorities and one each for the rest plus one for low-lying (i.e. 7 project profiles)
3. One each for top five and one combined for last five plus one for low-lying (i.e. 7 project profiles)
4. One combined for top 5, five separate ones for top five plus one for low-lying (i.e. 7 project profiles).

After much discussion on the options it was agreed that while all priority sectors for adaptation actions are relevant and necessary to meet urgent and immediate

needs for Solomon Islands' response to adverse impacts of climate change and sea level rise, it would be prudent to include all highly ranked sectors (importance factor of >10) into one project profile. This would increase the chances of their implementation with greater urgency and with funding support from the LDCs Fund (LDCF). It would also allow an integrated response to Climate Change impacts.

Based on the high ranking of the priority sectors (i.e. sectors with importance factor of 10 and above) and the greater likelihood of accessing funding support from the LDCs Fund for the implementation thereof, it was decided that option 3 would be pursued in developing project profiles; i.e. 7 project profiles representing one for five highest ranking (>10) sectors, one each for the rest and one focusing on low-lying and artificial islands.

It is important to note that all prioritised sectors for adaptation are important and therefore every effort will be made to seek support for the implementation of adaptation actions both from within and external sources. The NAPA process has highlighted the need to seek and access support for the implementation of adaptation actions covering the prioritised sectors. With support from the LDCF the intention of the government to carry out adaptation actions on all the priority sectors either through its mandatory sectoral activities or through funding support from other multilateral and bilateral development partners.

## CHAPTER 5. LIST OF PRIORITY ADAPTATION ACTIVITIES

The project profiles have been designed to reflect the need for urgent and immediate adaptation actions in agriculture and food security, water supply and sanitation, education, awareness and information, human settlements, human health, waste management, fisheries and marine resources, infrastructure, coastal protection, and tourism. Agriculture and food security, water supply and sanitation, human settlements, human health, education, awareness and information have been included in one project, while each of the others (fisheries and marine resources, infrastructure, waste management, coastal protection and tourism) has one project profile.

The notion that climate change education, awareness and information is highly relevant for capacity building for adaptation is well reflected as one of the high priority areas for action. However, given its cross-cutting nature education, awareness and information is included as a component of project activities under various sectors within the respective projects.

In addition, given the highly urgent need for adaptation action in low-lying and artificial islands it was decided to develop one project profile focusing on urgent adaptation action to be implemented in these areas.

The prioritization and ranking of key sectors which require urgent and immediate adaptation actions are included in the following seven project profiles:

### ***5.1 MANAGING THE IMPACTS OF, AND ENHANCING RESILIENCE TO, CLIMATE CHANGE AND SEA-LEVEL RISE, ON AGRICULTURE AND FOOD SECURITY, WATER SUPPLY AND SANITATION, HUMAN SETTLEMENTS, HUMAN HEALTH AND EDUCATION, AWARENES AND INFORMATION.***

#### ***Goal***

*To increase the adaptive capacity and resilience of key vulnerable sectors*

#### ***Rationale***

The NAPA process has emphasized that adverse impacts of climate change in Solomon Islands will be felt in critical human systems affecting agriculture and food security, water supply and sanitation, human settlements and human

health. These vulnerabilities are being exacerbated by lack of understanding, awareness and information regarding the adverse impacts of climate change and consequent sea-level rise. Most communities will be able to withstand and/or cope with negative effects of climate change and sea-level rise if they can better understand and are aware of the linkages between their experiential evidence of effects of climate change on the key sectors they depend on. Thus information will enable informed decision-making in respect of adaptation strategies, measures and actions.

### *Description*

The adverse impacts on agriculture and food security are a major concern for many communities and/or villages. Evidence from changes in temperature and rainfall and the occurrence of tropical cyclones in Solomon Islands will have long-term effects on food production systems. These are likely to be exacerbated by the climate change and sea-level rise. Some of the impacts of concern are: increased intensity and frequency of tropical cyclones (e.g. Cyclone Namu destroyed rice industry in 1986); occurrence of pests and diseases; storm surges and flooding; sea-level rise and coastal erosion and inundation; increased temperatures; drought and ENSO-related changes to temperature and rainfall.

Water resources will also be affected immensely by climate change and sea-level rise. Adequate water supply is considered one of the key elements of food security and therefore directly linked to people's livelihood. Thus any change in rainfall will trigger changes in water supply. Water in Solomon Islands is sourced mainly from rivers and streams originating in high mountain and dense forest catchments on high islands, rainwater harvesting (especially on artificial islands) and from thin freshwater lens of underground aquifers on small low-lying atolls and islands. These sources will be affected by climate change and sea-level rise on both high and low-lying islands. Information provided by communities and/or villages indicate that they are already experiencing contamination of their freshwater sources by rising sea levels (low-lying atolls), water shortages, saltwater intrusion and flooding of rivers and streams.

Closely associated with adequate water supply is the potential for declining quality of water related to unsanitary conditions. Communities and/or villages have often mentioned that sanitation is of great concern to settlements on low-lying coastal areas, islands and atolls. The human sewage, household and other debris is often washed up on public areas during flooding, storm surge, and coastal erosion associated with tropical storms. Wave storms and flooding also contaminates potable water and together with human sewage and debris pose a serious health risk to the communities and/or villages.

Droughts in Solomon Islands have caused serious shortages of water supplies. For example the 1997/1998 ENSO had caused reduction of water supplies by 30-40% in Honiara. Flooding also causes serious health risks. For example an increase in urban flooding undermines the water quality of town water supply and services as well as water infrastructure. Saltwater intrusion and sea-level rise has caused damage to water infrastructure and contaminated freshwater supplies.

Education, awareness and information on climate change impacts targeted to the needs and interests of the community are important tools to raise awareness of the impacts on water supply and on how to protect water supplies in the event of a climate extreme. Awareness raising and training will be focused at the central government level to help facilitate the inclusion of adaptation strategies to protect water in nation plans and budgets.

Awareness-raising with key stakeholders across the country is also needed such as for water services providers when discussing the rationale for any planned changes in the groundwater extraction rate for town water supplies. The NDMO continues to facilitate awareness programs through the local radio to promote education and awareness of various disasters to the general public and preparedness for such disasters should they occur.

This project is divided into five components focusing on the respective highly ranked priorities (agriculture and food security; water supply and sanitation; education, awareness and information; human settlements; and human health).

## **Component 1: Agriculture and Food Security**

### ***Objectives***

*The main objective of this component is to “increase the resilience of food production and enhance food security to the impacts of climate change and sea-level rise.”*

This project will ensure that the future food security and food production is maintained in a sustainable manner. The project will facilitate the development and implementation of the following key priorities for food production and foods security in the country:

- a) National Food Security programme - The food security issue is common to all service providers in the agriculture sector.

- b) Provincial Food Banks - To mitigate and prepare against the effects of climate change such as cyclones, tsunamis, floods, and pest outbreaks, provincial food banks must be established at strategic sites.
- c) Crop diversification - The introduction of various crops to boost food production and economic development in the country must continue. This activity can be done by all players in agriculture development.
- d) Tolerant crop species - salt, drought, high rainfall, etc. - Crop varieties that are tolerant to extreme effects of climate change must be identified and rapidly propagated and distributed to hot spots.
- e) Rapid Response to disasters - exotic pests and diseases outbreaks, floods - An agriculture rapid response center must be established to prepare for any disasters such as pest and disease outbreaks.
- f) Weather forecasting- Predicting outbreaks of pest and diseases on crops - Developing capacity and capability to predict weather patterns such as weather simulations and pest and disease outbreaks would reduce crop losses.
- g) Weather stations establishment at agriculture production areas - The establishment of weather stations at agriculture field stations would ensure that data on rainfall, sunlight, and temperature are kept. This information is critical for crop production.
- h) National Urban Fruit Tree Planting - Planting fruit trees in urban centers such as Honiara, Auki, Gizo, Kirakira, Buala, Lata, Taro, Tulagi, and Tingoa. This will serve two purposes; as a source of fresh fruits and as beautification of the towns.

**Outcome 1:** Increased production of food crops in small islands' communities/villages

**Outputs:**

- 1.1 Arable land improved and rehabilitated
- 1.2 Coastal/flood protection systems constructed
- 1.3 Seawall/access roads and other protective systems upgraded and developed.
- 1.4 Organic composting encouraged and soil fertility maintenance improved
- 1.5 Diversification of food crops with a focus on improving access to foods promoted and used - e.g. introduction of salt-tolerant and high-yielding crop varieties
- 1.6 Food storage infrastructure and/or facilities constructed.
- 1.7 Food security program and extension services established
- 1.8 Important fruit trees are replanted and protected.
- 1.9 Capacity built for financial planning to manage family assets in times of food shortage

**Outcome 2:** Enhanced self-reliance and food security preparedness

**Outputs:**

- 2.1 Access to income generation and markets improved.
- 2.2 Small-scale income generation activities (e.g. retail and wholesale business) encouraged and promoted.
- 2.3 Diversification of crops.
- 2.4 Information on other business opportunities and income-generating activities disseminated.
- 2.5 Food banks established
- 2.6 Training small-scale entrepreneurs provided and up-skilled

**Outcome 3:** Sustainable land management

**Outputs:**

- 3.1 Impacts of saltwater intrusion, droughts and floods, sea-level rise, salt spray, storminess managed and understood.
- 3.2 Level of Soil fertility increased and management improved
- 3.3 Food crops, tree crops, livestock, cash and subsistence crops managed
- 3.4 Climate-resilient farming techniques and sustainable agriculture developed and used.
- 3.5 Climate change adaptation and mitigation incorporated into development planning.
- 3.6 Sustainable agriculture promoted.

**Outcome 4:** Improved early warning system and improved agricultural information

**Outputs:**

- 4.1 Rapid response mechanism for responding to natural disasters developed.
- 4.2 Weather forecasting and information for farmers improved.
- 4.3 Weather stations in agricultural production areas established.
- 4.4 Training of adaptation experts in extension teams.
- 4.5 Implementation of pilot projects in local communities – rainwater harvesting, measures to reduce soil erosion, changes to design of reservoirs and irrigation channels to prevent risks from peak flows.

#### 4.6 Dissemination of lessons learned at national and international levels

**Outcome 5:** Provision of effective climate information products and services to land and water resources managers.

**Outputs:**

- 1.1 Communication of climate information products and services strengthened
- 1.2 Farmers, land and water managers educated and trained on various decision-support tools.
- 1.3 The linkages between national meteorological and hydrological services and land and water managers strengthened.
- 1.4 Emergency toolkits for land and water resources management developed.
- 1.5 Agriculture, forest, and water managers trained to integrate climate change adaptation and mitigation.
- 1.6 National meteorological and hydrological services strengthened.
- 1.7 Public awareness and information on climate change impacts on food production heightened.

#### **Component 2: Water Supply and Sanitation**

*The main objective is to increase the resilience of water resources management to impacts of climate change and sea-level rise.*

The impact of sea-level rise will be strongly affected by human responses to the risks. The areas which are most vulnerable to sea-level rise are low-lying islands, atolls and flat deltaic regions at the mouth of larger rivers. Studies suggest that hundreds of small islands could permanently inundate and their cultural heritage lost in the event of a one meter sea-level rise. Intrusion of salt water from rise in sea level affect groundwater resources, especially small atolls and low-lying islands which rely on rainfall or groundwater for water supplies.

Incorporation of climate change considerations into the planning and design of infrastructures both urban and rural would assist in the mitigation against hazards and adaptation to climate change. Integrating climate change as formal considerations in the planning, design, construction, operation and management of water resources projects should be a government policy in order to mitigate and adapt to impact of climate change.

The overall objective of the water resources programme is to apply hydrology to meet the needs for sustainable development and use of water and related resources; to the mitigation of water-related disasters; and, to effective environmental management in the country. The government recognises that safe drinking water and proper sanitation facilities are basic necessities to better health. Basic water resources assessment program should support activities related to the impacts of climate change and variability and climate related extremes in Solomon Islands. These programs include:

- a) Promoting activities in operational hydrology to further hydrological services in Solomon Islands through the collection, processing, storage, retrieval and publication of hydrological data, including data on the quantity and quality of both surface water and groundwater; the provision of such data and related information for use in planning and operating water resources projects to meet the needs for sustainable development and use of water and related resources to benefit rural communities; to the mitigation of water and climate change related disasters; the provision of appropriate water and related information to Solomon Islands Water Authority (SIWA) to improve its service delivery and to provide for effective water resources and environmental management in Solomon Islands.
- b) Program on capacity building in hydrology and water resources should provide a framework by which national hydrological services can seek advice and assistance and provide support to efforts to build capacities to serve the country including the education and training of staff, increasing public awareness of the importance of hydrological work, impacts of climate change and support to technical cooperation activities.

**Outcome 1:** Integrate water conservation and sustainable water resources management in all sectors and communities.

**Outputs:**

- 1.1. Construction of village/community water tanks
- 1.2. Construction of water reservoirs for institutional and residential areas.
- 1.3. Upgrading of existing reservoirs, protective structures/access roads.
- 1.4. Promote/build household rainwater harvesting.
- 1.5. Construction of strategic storage water reserve tanks.
- 1.6. Construct engineered or “climate proofed” water reservoirs.
- 1.7. Develop and implement Water Use efficiency Plan.
- 1.8. Raise awareness for water conservation.

**Outcome 2:** Incorporate climate change adaptation strategies into the guidelines and criteria for design and construction of appropriate water infrastructure in vulnerable areas.

**Outputs:**

- 2.1 Guidelines for development of water supply in rural areas developed.
- 2.2 Inventory of POPs and adequate storage and leakage prevention conducted.
- 2.3 Good practice guidance for pesticide storage and use, and application developed and used.
- 2.4 Drought and its effect on water distribution in rural areas assessed.
- 2.5 Rainwater harvesting technologies developed and used.

**Outcome 3:** Increased reliability and quality of water supply to all sectors and communities

**Outputs:**

- 3.1 Capacity of water supply increased
- 3.2 Water reticulation and distribution systems improved and where necessary constructed
- 3.3 Arable land improved and rehabilitated
- 3.4 Sustainable use of water on commercial agriculture land
- 3.5 Build appropriate low-technology irrigation system for farmers.
- 3.6 Diversification food crops with a focus on high-yielding crop varieties promoted.
- 3.7 Promote water conservation and water use efficiency
- 3.8 Prevent land-based pollution.

**Outcome 4:** Enhanced institutional and legal framework for water resources management

**Outputs:**

- 4.1 Individual and institutional capacity for sustainable water management built and/or enhanced.
- 4.2 Water resources sector policy developed and implemented.
- 4.3 Water resources sector legislation developed and adopted.

#### 4.4 Water sector plans and programmes developed and implemented

### **Component 3. Human Settlement**

*The main objective of this component is to improve the capacity for managing impacts of climate change and sea-level rise.*

Additionally, there are also communities and/or villages that have been created as a result of the British Colonial Policy in the then British Solomon Islands Protectorate which are now faced with dealing with the adverse impacts of climate change and sea-level rise. Many of these communities and/or villages are located in highly vulnerable areas.

Both groups of people (islands people and migrants) have often moved partially as a consequence of disasters as well as opportunities for employment. Such communities often have very limited resources (natural capital) and adaptation options. One of the key potential adaptation options for many of these communities and/or villages is to relocate. The question of relocation has serious political, economic and socio-cultural implications.

Given the above, the focus of this component is to enhance the capacity of such islands and communities to plan for adaptation.

**Outcome 1:** Completed community vulnerability and adaptation assessments.

#### **Outputs:**

- 1.1 Consultations and assessments with the communities conducted.
- 1.2 Adaptation plans for communities prepared.
- 1.3 Awareness on climate change impacts promoted and information disseminated.
- 1.4 Key vulnerabilities and adaptation options, strategies and measures identified

**Outcome 2:** Improved community adaptation planning

#### **Outputs:**

- 2.1 Relevant authorities are consulted
- 2.2 Relevant resources owners are consulted

- 2.3 Plan for adaptation actions adopted
- 2.4 Key community adaptations implemented

#### **Component 4 Human Health**

*The main objective of this component is to increase the capacity of health professionals to address adverse impacts of climate change on human health.*

In the Solomon Islands the climate change and climate variability including extremes cause adverse impacts such as floods, storm surge and tropical cyclones. Information of late has shown that climate change and variability increases the potential for increase in tuberculosis and leprosy through mobility of the population, concentration of the people in an area and poor living conditions. These conditions are exacerbated by shortage of potable water (especially on low lying islands), and poor sanitation. Water resources are often affected by storm surge and wave-overtopping while sea-level rise affects sanitation.

Another area of concern is that during high rainfalls and very high tides water and sea would flood the villages, bringing in faeces from traditional toilets (from the surrounding areas) into the villages. Helminthes and other parasites brought in through this mechanism are easily passed on to children and adults.

Rainfall is becoming more frequent causing floods and water logging in flat areas. Root crops and vegetables could not grow in such conditions. Eighty percent of this country lives in rural areas and such disaster could cripple the country with regards to health and nutrition. High and intense rainfall causes respiratory infections, high parasite infections such as diarrhea.

Malaria is transmitted by mosquito and mosquito's life cycle depends on breeding sites and humidity, both which the climate dependent. A lot of rain results in a lot of breeding sites. A lot of breeding sites means an increase in mosquito population and an increase mosquito population results in high malaria transmission. A lot of rain induces high humidity. Humidity is necessary for the survival of mosquitoes and the development of malaria parasite in them. These factors increase the efficiency of transmission of malaria.

There is no program specifically developed to address the impact of climate change. However the present programs contain activities that address health problems that are increasing due to climate change. Climate change causes frequent rainfall and flooding. This has resulted in the destruction of root crops

and vegetables creating problems of lack of or shortage of proper food and increase in malnutrition and other non-communicable diseases.

The MHMS does not have any response strategy addressing climate change issues as yet. Thus the impact of climate change and variability on health is not an issue of concern. However, the MHMS intends to establish a country-wide programme on climate change and health under this programme which will include: advocacy; social mobilization; and community and behavioral change. The programme will facilitate climate change and health awareness-raising dissemination of results of research and training, increase the supply of bed-nets in affected areas, relocate health facilities from disaster-prone areas (e.g. from low to high ground), increase the supply of vitamins to populations affected by floods and storm surge, improve surveillance and monitoring of climate-related diseases and improve emergency services and improve climate change capacity-building and training to health professionals.

**Outcome 1:** Improved understanding of the relationship between diseases and climate change and variability.

**Outputs:**

- 1.1 Manual/guidelines on incidence of malaria and climate change and variability developed and used.
- 1.2 Community-based health and climate change awareness programme developed and implemented.
- 1.3 Targeted groups (women and youth) trained on health impacts, disease prevention, contamination of water supply prevention and managing sanitation during and after climate-related disasters.
- 1.4 SIMTRI strengthened to conduct education, awareness-raising and information dissemination on impacts of climate change on human health.

**Outcome 2:** Strengthened capacity and capability of MHMS to address impacts of climate change on human health

**Outputs:**

- 2.1 Disease outbreaks predicted and efficiently managed.
- 2.2 Disease prevalence reduced
- 2.3 Climate change impacts on health mainstreamed into health planning
- 2.4 Information and data for early warning developed and implemented

## **Component 5          Education, awareness and information on climate change**

*The main objective of this component is to promote climate change education, awareness and information dissemination.*

There is generally a lack of public understanding, awareness and information on the impacts of extreme events caused by climate change. Information from non-government organisations indicated that very little or no training, is done on climate change and related issues and/or concerns. However, it was noted that education and training of the public and stakeholders, including policy-level decision makers, are important catalysts for assessing vulnerabilities and planning of adaptation activities, as well as implementing adaptation plans. It is important to communicate both successful and unsuccessful efforts at planning and implementation of adaptation activities.

In the Solomon Islands school curriculum, impacts and issues of climate change is covered in science and social science syllabuses under topics like weather, earth and beyond and pollution but is limited to the topics themselves. In other subjects there is no or little mention of climate change or related topics. Therefore climate change issues are not directly covered in the syllabuses but only within certain specific topics.

In Teacher training at the School of Education (SOE), SICHE, topics on climate change impacts on islands ecosystem is covered in biology courses but with more emphasis on the ecosystem rather than impacts caused by climate change. Other five schools within SICHE also run programs with little or no climate change related courses.

It was also noted that awareness on climate change risks and the need for adaptation should be raised among key sectors and mass media, including the use of current events such as economic, weather and health crises, as a basis to promote adaptation measures with co-benefits. Improving public awareness and developing overall communication strategies makes climate change science accessible to average citizen and can reduce their vulnerability. Besides, awareness-raising at village community, schools and institutions, it is also important to involve high-level policymakers to ensure the integration of climate change risks into national development policies.

Capacity-building for schools, institutions, youths and community levels is vital in enabling a developing country like the Solomon Islands to adapt to climate change. It is important for the government, donors and other stakeholders to recognize the role of schools, institutions and village communities in the dissemination of information on climate change to the public.

**Outcome 1:** Incorporation of climate change issues and concerns into school syllabuses.

**Outputs:**

- 1.1 Curriculum officers trained to incorporate climate change issues and concerns into school syllabuses
- 1.2 Courses on climate change impacts for teacher training developed and implemented.
- 1.3 Courses on climate change impacts on agriculture, forestry, health, fisheries and marine resources within the curriculum developed and implemented.
- 1.4 Understanding and awareness of impacts of climate change on rural communities improved.

**Outcome 2:** Development of Teaching Manual on impacts of climate changes for use in teacher training.

**Outputs:**

- 1.1 Documentation on all areas currently affected by climate change-related extreme events prepared.
- 1.2 Teaching manual on impacts of climate changes for rural communities developed and implemented.
- 1.3 Courses on climate change into the school curriculum designed and implemented.
- 1.4 Teacher education strengthened.
- 1.5 Knowledge and awareness on climate change improved.

***Budget***

It expected that a total of USD6,500,000.00 will be sought from the LDCs fund (LDCF) through the GEF and other multilateral and bilateral development partners. Co-financing of this project will be sourced from the other development partners, national government and other bilateral agencies working in the health sector in the Solomon Islands.

## **5.2 CLIMATE CHANGE ADAPTATION ON LOW-LYING AND ARTIFICIALLY BUILT-UP ISLANDS IN MALAITA AND TEMOTU PROVINCES**

### ***Goal***

*The main goal is to facilitate adequate adaptation to climate change and sea-level rise*

### ***Rationale***

While most communities are making every effort to deal with and cope with the changes resulting from climate change, variability and extreme events, there are some communities who have very limited opportunities for adaptation to climate change. These areas include Langalanga, Kwai, Ngongosila and Lau where most of the settlements are built on water. Others include the low-lying atoll islands of Ontong Java, Sikaiana, and Reef Islands. The settlements built on water depend almost entirely on rainwater and the supply of materials and resources such as mangrove for timber and firewood and sago palms for construction are in decline. In other low-lying atolls the vagaries of climate change and sea-level rise are putting additional pressure on limited resources.

The adverse impacts of climate change, climate variability and extreme events are manifested in the various changes that people experience and some adaptation effort is already being undertaken as a matter of course (outlined above). However many communities and/or villages have indicated that in order for them to better understand the adverse impacts of climate change and be able to make informed decisions about adaptation it is vitally important the climate change education, awareness-raising and information dissemination becomes part of long-term adaptation effort in the Solomon Islands.

Most communities and/or villages depend on subsistence activities for their livelihood. However increasing demand for material goods and services in a modern growing economy makes cash income opportunities necessary. Thus any adaptation measure, option and strategy will necessarily include income-generating opportunities and the infrastructure to support such effort. For example, Solomon Islanders depend entirely on road and sea transport to move their produce to market. If heavy and intense rains and sea storminess continues as often as it is being experienced now the ability of people to move their produce to market is seriously compromised.

## *Description*

The NAPA process has identified the low-lying and artificially built-up islands as being the most vulnerable to climate change and sea-level rise. As indicated in Project Profile 1, Component 3, many of these communities and/or villages live on or at the edge of the sea and are often subject to impacts of storms, storm surge, sea-level rise, drought, saltwater intrusion, and flooding. For most of these communities relocation is a potential adaptation measure. However, relocation is problematic when they do not own land resources on nearby islands thus land tenure and land management systems prohibit any discussion let alone relocate to nearby islands. For example, Langalanga people cannot move to nearby island where they do not own land and its resources.

Relocation of communities and/or villages will necessarily become the responsibility of the governments at all levels (i.e. community/local, provincial and national).

*Objective:* To develop and implement plans to relocate as an adaptation measure.

### **Outcome 1: Develop and implement plans for relocation of communities**

#### **Outputs:**

- 1.1 Capacity-building for adaptation planning conducted.
- 1.2 Vulnerable communities and government authorities consulted.
- 1.3 Land and resources owners consulted.
- 1.4 Plans for new settlements prepared and approved.
- 1.5 Communities and/or villages relocated.
- 1.6 Dialogue between the migrants and land and resource owners strengthened.

*Implementation* – see Chapter VII.

#### *Sustainability of the programme*

Distribution of lands currently do not account for the impacts of climate change and sea level rise. However, from the analysis of human settlements, relocation of communities will become one of the few practical options (if not the only one) for adaptation to climate change by communities and/or villages residing on houses built over the sea and low-lying atolls. There is currently no legislation or a legal framework which would allow climate change-affected communities to

relocate. Thus relocation will require specific legislation and a legal framework to guide the process at every level of government.

The biggest risk is that land owners and resource owners may not agree to the terms and conditions of relocation and also may claim compensation to the amounts that could be prohibitive for the government. It is therefore imperative to engage the relocating people and the resource owners at the very early stage of planning. Such engagement and continuous dialogue will ensure the long term sustainability of this programme.

### ***Budget***

It is expected that an amount of USD3,500,000.00 will be requested from the LDCF through GEF and other multilateral and bilateral development partners to fund this programme. Co-financing will be sought from other development partners and the government budgetary support.

## **5.3 WASTE MANAGEMENT**

### ***Goal***

*Main goal of this project is to better manage impacts of climate change on waste management*

### ***Rationale***

Droughts resulting from climate change, unlike floods have had little appreciable impact on waste management. Whilst effects of flooding including climate induced events are significant to waste management. With slack management practices as is current throughout much of the country; events of heavy rainfall can result in drastic negative waste repositioning impacts, such as waste from upstream can reach newer downstream locations that may subsequently contribute to causing coastal pollution.

Climate change induced fires including bush fires is a living threat particularly with prolonged drought periods. And the aftermath of such events can be drastically wasteful and can contribute to accumulation of large quantities of waste of disaster proportions.

As an island nation impacts of sea level rise including storm surges is an ever present threat. Concerns with storm surges extend beyond causing waste management issues, to property damage and even threats to peoples lives. In coastal towns and environments with uncoordinated waste disposal practices, storm surges would contribute directly to redepositing of coastal waste to coastal strips which are public access areas.

Tropical cyclones are increasingly becoming a common occurrence and its destructive effects contribute a great deal to accumulation of debris and waste. Minimum standards in disaster response, particularly for the relief phase of disasters normally address urgent needs of waste management. The follow on rehabilitation for waste management is the responsibility of the Government. Provisions under the currently developed waste management regulations would provide for national coordination with other relevant departments and organizations.

Whilst dealing effects of climate change is not an easy task. Appropriate education and awareness is the alternate and practical option to pursue. Naturally, time and patience are basic necessities required from the outset to convince minds and hearts of people to make easy the task of education. Any such awareness programme must call for expert input to tailor made a well designed waste management educational programme that can be easily communicated for ease of digestion by the majority of Solomon Islanders. That too would necessitate serious consideration of dissemination tactics and methodologies that have been proven to work in our local environment.

**Objective:** To develop a national integrated sustainable Waste Management Plan and Strategy for incorporating impacts of climate change.

**Outcome 1:** To develop a database on impacts of climate change on waste management.

**Outputs:**

- 1.1 Data and information on impacts of climate change on waste management developed and used.
- 1.2 Climate-friendly and appropriate technologies for waste management identified and used.
- 1.3 Guidelines for waste management in climate-sensitive and highly vulnerable areas developed and implemented
- 1.4 Promote awareness and information exchange on waste management and impacts of climate change

**Outcome 2:** Encourage incorporation of impacts of climate on waste management into educational curricula.

**Outputs:**

- 2.1 Curriculum on impacts of climate on waste management is developed and implemented
- 2.2 Understanding of impacts of climate change on waste management is enhanced.
- 2.3 Climate change issues are incorporated into waste management regulations.
- 2.4 Infrastructure for waste disposal systems climate-proofed.

**Implementation** - See Chapter VII

**Sustainability of the programme**

Waste management is currently implemented under various legislations and by-laws. The absence of an institutional framework for managing waste means that waste is managed on a piece-meal basis. The growth of provincial and national towns have increased the production of waste. Some issue of concern for sustainability include very old and rundown liquid waste networks, land tenure issues preventing new areas being developed for waste disposal and expansion of sewer networks. Unplanned urban development is also putting pressure on old sewer networks and the reliance on septic tanks particularly in exposed areas are prone to adverse impacts of climate change and sea level rise.

**Budget**

The cost of this project is estimated at USD1,500,000.00 which will be sought from the LDCF through GEF and other multilateral and bilateral development partners. Co-financing of this project will be sourced from government's recurrent expenditure, bilateral aid donors and others.

## 5.4 COASTAL PROTECTION

### *Goal*

*The main goal of this project is to increase the resilience and enhance adaptive capacity of coastal communities, socio-economic activities and infrastructure*

### *Rationale*

A major find of the first national communication is that coastal environments and systems are at risk from sea level rise and warmer sea temperatures. Areas most vulnerable to flooding and inundation as a result of sea level rise, with the combined effects of seasonal storms, high tides and storm surges associated with tropical cyclones, are the populated coastal lowlands and low-lying islands and atolls. Coastal erosion is already evident in many parts of the country.

Additionally, coral bleaching has occurred during El Nino events. Corals are highly sensitive temperature changes therefore a slight increase in water temperature causes bleaching.

Mangroves and Reefs ecosystems are breeding grounds for commercially important species of fish and shellfish located on shallow coastal waters. Mangroves in particular are an important breeding grounds and habitats for crabs prawns and important food species. Therefore change in water temperature or sea level rise threatens such breeding grounds, and other coastal habitats.

Changes in weather and ocean temperature can affect fish behavior and migration patterns. The NCSA stock take report highlighted that Solomon Islands Tuna industry could be affected with changes to ocean temperature. El-Nino could affect fishing industry terms of quantities and species composition. This could lead to a decline in fisheries productivity and earning in exports

Huge populations of Solomon Islands reside along low lying coastal areas and therefore heavily rely on marine and fisheries resources. Climatic factors such as sea level rise rainfall, strong winds, storm frequency, salinity, unusual tides, salinity and groundwater level could affect the productivity of marine and fisheries resources.

Coral reefs and Mangroves acts as buffer barriers zones protecting coastal communities and low lying areas from storms, tides, cyclones and storm surges and have important social and cultural importance.

There is a need for proper assessment has been done on the impacts of climate change on the coastal environments in the Solomon Islands. However increased erosion rate has been experienced from climatic conditions associated with human induced factors.

### *Description*

The implementation of integrated coastal zone management (ICZM) will entail the implementation of sustainable projects that will create coastal sanctuaries and ecological parks that will act as buffers to extreme climate-related events, protect the environment and promote sustainable coastal development. Adaptation interventions will include (soft) non-structural and structural (hard) options that compliment each other. The listed activities below indicate community efforts to improve communities' resilience to natural hazards and for conservation and protection from further degradation.

Activities could include improving and rehabilitating coastal land, construction of coastal/flood protection systems, gravelling and upgrading/construction of seawall/access roads and regeneration and restoration of mangrove areas.

**Objective 1:** Integrate climate change adaptation (climate proofing) into construction of a roads and other infrastructure.

**Outcome 1:** Construction and climate-proofing of engineered coastal roads, bridges and other key infrastructure.

#### **Outputs:**

- 1.1 Construction of coastal/flood protection systems
- 1.2 Gravelling and upgrading of seawall/access roads
- 1.3 Construction of culverts, drainage, and outlets

**Outcome 2:** Integrated coastal zone management

#### **Outputs:**

- 2.1 Replanting of foreshore vegetation
- 2.2 Protection of lagoon and fringing reefs coral reefs
- 2.3 Establish set-back zones
- 2.4 Construct seawalls or other protective measures in built-up areas or critical socio-economic infrastructure and activities
- 2.5 Prevent land-based pollution

- 2.6 Institute and administer appropriate/relevant traditional resource management systems
- 2.7 Promote education, awareness and information on impacts of climate change on coral reefs and other sensitive marine ecosystems.
- 2.8 Protect and where relevant rehabilitate coral reefs and mangroves in build-up coastal areas.
- 2.9 Promote coastal zone management (ICZM) and integrate climate change adaptation into sustainable coastal development.
- 2.10 Produce country-driven guidelines/manuals for managing coastal and marine resources.
- 2.11 Promote and enhance income-generating opportunities in coastal communities
- 2.12 Establish monitoring and evaluation of coastal zone management
- 2.13 Protection of forests and littoral vegetation

**Outcome 3:** Enhanced self-reliance and food security preparedness

**Outputs:**

- 3.1 Improve access to income generation and markets
- 3.2 Encourage small-scale income generation activities (e.g. retail and wholesale business)
- 3.3 Provide information on other business opportunities and income-generating activities
- 3.4 Provide training/support to and up-skill small-scale entrepreneurs

*Implementation* – See Chapter VII.

***Sustainability of the programme***

The CNURA policy document has been very clear on its intent in the issues addressing environment issues and climate change. MECM established by CNURA government is committed to *ensure the sustainable utilization and conservation of the natural resources and environment* and successful adaptation to climate change. MECM will work in partnership with other line ministries, provincial governments, non-government organisations and communities in ensuring that coastal management will be sustainable over the long term.

***Budget***

The total cost of this project is estimated at US\$1,750,000.00 which will be sought from the LDCs fund through the GEF and other multilateral and bilateral development partners. Co-financing of the project will be provided by the

national government, bilateral development partners and other multilateral agencies working on coastal issues, problems and areas.

## **5.5 FISHERIES AND MARINE RESOURCES**

### ***Goal***

*To improve the understanding of the effects of climate change and climate variability including El Nino-Southern Oscillation on the inshore and tuna fishery resources*

### ***Rationale***

The Solomon Islands has a rich and varied marine sector that is vitally important to the Solomon Islands people as a major food source, and to the economy for its export earnings. Marine resources also offer the potential for further commercial development, in ways that can be sustainably managed. The result would be a reliable and strong economic base for the nation well into the future. The ability to manage sustainably and the size of the resource makes the marine sector one of the most valuable long-term assets in the Solomon Islands.

### ***Description***

The health of the marine ecosystems is a major concern because of the potential impact on the health of the people, the availability of food, and the importance of the marine environment in attracting tourists to the Solomon Islands. Monitoring programs need to be put in place in sensitive areas so that the agencies and the local people can measure the changes that are taking place, and act before there is a degraded fishery. The formulation and adoption of lagoon management plans will be one component of a total solution. However ownership of the solution by the community, and the integration of the efforts of all the relevant agencies is seen as essential to being able to write comprehensive and relevant management plans, and ensuring that they are put into practice.

**Objective 1:** To improve the capacity to protect inshore fisheries and marine resources.

**Outcome 1:** Promote education, awareness and information on the impacts of climate change on fisheries and marine resources.

**Outputs:**

- 1.1 Stock assessment of near-shore fisheries and marine resources conducted.
- 1.2 Locally-driven indicators for monitoring of the coastal resources developed.
- 1.3 A guidebook on effects of climate change and variability on inshore marine resources prepared and disseminated.

**Outcome 2:** Protect and monitor coral reef bleaching.

**Outputs:**

- 2.1 Sensitive marine habitats protected.
- 2.2 Damaged reef areas rehabilitated.
- 2.3 Locally-driven monitoring system for inshore fisheries and marine resources developed.
- 2.4 Sustainable fishing techniques promoted.

**Outcome 3:** Establish coastal buffer zones and rehabilitate mangrove forests.

**Outputs:**

- 3.1 Mangrove replanting encouraged and promoted.
- 3.2 Guidelines for mangrove replanting developed and disseminated.
- 3.3 Set-back zones established.
- 3.4 Monitoring system for mangrove encroachment established.

*Implementation:* See Chapter VII.

***Sustainability of the programme***

Exploitation of fisheries and marine resources provides a sustainable livelihood for many communities and/or villages on all islands. However, this livelihood will be seriously affected by climate change and sea-level rise while demand for fish for food will continue to increase putting additional pressure on the resources. The Ministry of Fisheries and Marine Resources will need to conduct public awareness campaigns on the effects of climate change and variability on inshore and tuna fisheries.

***Budget***

It is expected that an amount of USD1,500, 000.00 will be sought from the LDCF through GEF and other multilateral and bilateral development to support this project partners. Co-financing will come from the government's budgetary

allocation for MFMR, bilateral donors in the fisheries sector and other multilateral sources.

## **5.6 INFRASTRUCTURE DEVELOPMENT**

### ***Goal***

*To improve the resilience of key infrastructure to climate change and sea-level rise.*

### ***Rationale***

Solomon Islands struggles to cope with already highly variable climate, costing millions of dollars. Climate variability and change will exacerbate pressure on sensitive environmental and human systems including key infrastructure. Many of its roads, bridges, airports and wharves are built in or near disaster prone areas. Thus the protection and resilience of these infrastructures will be important for achieving sustainable development in the long term.

### ***Description***

Coastal zones in the Solomon Islands are often subject to adverse impacts of climate change and variability including extreme events such as tropical cyclones. Adverse impacts result from land loss due to inundation, coastal erosion, saltwater intrusion as a result of wave-overtopping and sea water flooding of both infrastructure and socio-economic activities. In most islands, coastal zones provide a lifeline infrastructure including harbours to much of their economies. Some of the provincial airports are located at or near the coastline.

Climate proofing the infrastructure will pave the way for a least cost design and implementation procedure integrated or mainstreamed into existing planning, design and implementation processes that take into account increased risk from climate change. The consequences of inaction or not taking into account climate change risks in an already vulnerable situation will result in high overall costs, including any rehabilitation costs which are likely to occur during the lifetime of the airport. This would enhance the livelihoods, improve adaptive capacity and foster sustainable development in the long term. The activities may include engineered design criteria that would allow for a 60-year storm event with particular wave heights for seawalls, hardstand/surface, retaining walls as well as a breakwater for dissipation of wave energy.

Other adaptation activities will include construction of coastal/flood protection/defence systems, gravelling and upgrading of seawall/access roads, strengthening of surface area and climate proofing drainage and other protective infrastructure.

**Objective:** Integration of climate change risk proofing into infrastructure design and development.

**Outcome 1:** Improved operational safety and efficiency of airport and airport facilities.

**Outputs:**

- 1.1 Climate proof design criteria for airport development with a 60-year recurrence interval developed and used.
- 1.2 Coastal/flood protection systems constructed.

**Outcome 2:** Constructing of an engineered protective structures in the harbour and coastal areas.

**Outputs:**

- 2.1 Detailed survey of the island coastal system to identify built up areas surveyed.
- 2.2 Protective seawalls, revetments, culverts, bulkheads, jetties and floodgates constructed.
- 2.3 Drainage system for the protection of airport built.

**Outcome 3:** Climate proof key infrastructure.

**Outputs:**

- 3.1 Foreshore vegetation replanted.
- 3.2 Seawalls or other protective measures in built-up areas or critical socio-economic infrastructure and activities constructed.
- 3.3 Land-based pollution prevented
- 3.4 By-laws and/or regulations governing siting of infrastructure developed and implemented.
- 3.5 Climate change and sea-level rise impacts integrated into environmental impact assessments.
- 3.6 60-year return interval in all infrastructure design and implementation adopted and implemented.

*Implementation:* See Chapter VII.

### ***Sustainability of the programme***

Development of infrastructure remains a key concern of the government. However, there are some risks such as sufficient political stability, continuous donor support, sound financial management, capacity and capabilities of the responsible agency and/or ministry and problems of high staff turnover. While the latter pose some risks to the sustainability of the programme, climate change will in no doubt have adverse impacts on key infrastructure. This will necessarily mean that livelihood and the economic activities will be compromised. The negative impacts of climate change and sea-level rise seem greater than those posed by the risks involved and therefore building resilience should not be delayed. Thus incorporation of climate change and sea-level rise in the design and construction should be the norm.

### ***Budget***

The total amount of funds to be requested from the LDCF through GEF and other multilateral and bilateral development partners is approximately USD2,000,000.00. Co-financing will be provided by other bilateral development partners and the national government.

## **5.7 TOURISM**

### ***Goal***

*To integrate climate change adaptation strategies and measures into tourism planning and development.*

### ***Rationale***

The heart of tourism attractions in Solomon Islands is a combination of its culture, natural resources and a wide variety of ecosystems. Key ecosystems offering certain sporting facilities and beach holiday facilities will be directly threatened by climate change and sea level rise. Ecosystem degradation in individual destinations will negatively impact on tourism in that destination. Thus the future success of tourism depends on the quality of the environment, and the development of land use practices/policies that preserve and enhance the biophysical resources on which its sits.

## *Description*

The environment and climate itself are part of the tourist attraction in Solomon Islands. In Solomon Islands most of the tourism infrastructure including resorts, roads and airports are concentrated on the coast. The tourism industry in Solomon Islands was drastically impacted upon by the ethnic tensions of 1998-2003 and continues to hinder development due to persistent problems with the country's image as a safe destination.

The tourism industry is seen to have failed to fully exploit the country's cultural, natural and historical assets and attractions. The government is aware that while tourism is not the only contributor to economic development in the country it is an important component.

Key hindrances to tourism development are land issues. 85% of the land in Solomon Islands is customarily owned where family group owners and boundaries are not formally recorded and are therefore open to disputes and at times conflict. There is an ineffective system to resolve these issues leading to uncertainty and can be a deterrent to potential investors and local entrepreneurs. In addition without formal title it can be difficult to obtain finance.

A review and update of the Tourism Development Plan supports previous findings that, as a tourism destination, Solomon Islands cannot sustain tourism development that is on a large scale or is mass tourism. It does not have the capacity to absorb the infrastructure, institutions and impacts such development would require and result in. The future of tourism development is in diverse, small to medium scale developments targeted at niche markets.

There is a pressing need for a new policy that should emphasize sustainable tourism planning and development with a focus across the provinces. The current Government Policy Implementation Framework 2008-2009 for the Ministry of Culture and Tourism focuses on tourism development that is sensitive to the diverse cultures and environments of the country and brings local benefits through job creation and poverty reduction. According to the Ministry's Corporate Plan its priorities include Tourism Policy Reform and Planning.

Coastal developments such as the construction of roads, hotels and residential areas are potential threats to coral reefs through increases in sediment run-off, and sand and coral rubble extraction for building. Hotels and resorts on the

shores usually have wharves and protective piers, which involve dredging the adjacent reef for rocks and creating boat channels. Once resorts are established, most resort owners seek to protect the surrounding reef life to enhance scuba diving. Most tourist operations have positive impacts on coral reefs, especially those involved in scuba diving, and some operators have taken measures to protect nearby reefs. They are also valuable sources of information about the state of coral reefs. Careless or inexperienced divers can contribute to coral reef damage by breaking corals, taking target species through spear fishing and purchasing large quantities of shells.

**Objective:** To build capacity in managing impacts of climate change on tourism.

**Outcome 1:** Integration of emergency planning tourism industry.

**Outputs:**

- 1.1 Consultations with relevant stakeholders conducted.
- 1.2 Tourism database established.
- 1.3 Training on emergency planning developed and implemented.
- 1.4 Emergency Plan developed and implemented.
- 1.5 Monitoring and review of emergency plan developed and implemented.

**Outcome 2:** First aid training of tourism operators conducted.

**Outputs:**

- 2.1 First Aid training kit developed.
- 2.2 Occupational Health & Safety procedures established.
- 2.3 Safety and emergency drills conducted.
- 2.4 Safety Manuals developed.
- 2.5 Group of resourceful personals organised.
- 2.6 Key personal in communities identified.
- 2.7 Traditional methods of food preservation (Relate to Agriculture & Health Sector) documented.
- 2.8 Traditional food preservation methods promoted and used.

**Implementation:** See Chapter VII.

***Sustainability of programme***

Solomon Islands has a fledgling tourism industry. Thus the full potential is not yet realized. There is some recognition that climate change and sea-level rise impacts will also affect tourism there is no clear policy on incorporation of climate change and sea-level rise issues into tourism development. This project will provide that vehicle for climate proofing tourism development in the country.

***Budget***

It is anticipated that an amount of USD500,000.00 will be sought from the LDCF through GEF and other multilateral and bilateral development partners. Additional funding will be through government budgetary allocations and bilateral donors.

**Table 3 Summary of Project budgets**

Priority	Priority Adaptation Activity	Budget (USD)
1	Agriculture and Food Security, Water and Sanitation, Human Settlements and Human Health, Education Awareness and Information	6,500,000.00
2	Low lying and artificially built-up Islands	3,500,000.00
3	Waste Management	1,500,000.00
4	Coastal Protection	1,750,000.00
5	Fisheries and Marine Resources	1,500,000.00
6	Infrastructure Development	2,000,000.00
7	Tourism	500,000.00
	Total	17,250,000.00

## CHAPTER 6. NAPA PREPARATION PROCESS

As part of the initiation of the process for the preparation of the NAPA of Solomon Islands an inception workshop was held in Honiara, Solomon Islands from August 29 to 31 2007. The workshop was divided into five parts, each focusing on a specific topic relevant for an inception workshop. The topics covered were: NAPA Process; implementation arrangements, Methodologies and tools for NAPA process; Institutional arrangements, formation of NAPA task teams and work plans and budgets. Thus the workshop had the following objectives:

- a) To brief the NAPA Coordinator and the NAPA Team on the objectives, agreed strategy, expected outputs and outcomes, of the NAPA project
- b) To provide an opportunity for the stakeholders and partners to provide input on the work plan and to confirm implementation arrangements both at the national and/or community/village levels;
- c) To provide an opportunity for engaging key stakeholders and to establish NAPA Task Teams to carry out the various tasks relating to the stakeholder consultations and vulnerability and adaptation assessments;
- d) To provide a forum for participants to share knowledge, experiences, and difficulties/constraints in preparing NAPA;
- e) The expected outcomes of the workshop are substantive comments as well as identifying needs and opportunities for further technical assistance during the course of the preparation of NAPA.

The workshop was hosted by the Government of Solomon Islands through its then Ministry of Communications, Aviation and Meteorology, where several staff of the Solomon Islands Meteorological Services (SIMS) provided the secretariat support for the workshop. A total of 26 participants (including two representatives from UNDP-Honiara Sub-Office) representing various government ministries, NGOs and community-based organisations.

The NAPA process and the NAPA guidelines for the preparation of NAPA were introduced and provided to the key stakeholders. The background to the scope and kinds of information that are relevant in the preparation of the NAPA were also introduced. The presentation also focused on the objectives, rationale, characteristics and guiding elements of the NAPA process. It also highlighted the need to prioritize urgent and immediate needs in the NAPA process as these needs and priorities will be included in the project profiles for further development and implementation.

In analyzing the NAPA documents which have been completed already a number of key lessons were identified which would guide the NAPA

preparation in Solomon Islands. It was noted that the structure of NAPA documents are consistent with the NAPA guidelines provided in decision 28/CP.7 of the UNFCCC. The most vulnerable sectors identified in earlier NAPAs are: agriculture, water resources, coastal zones, human settlements and infrastructure, terrestrial and marine ecosystems, and tourism. All countries used multidisciplinary and/or multi-sectoral approaches based on complementary information and sustainable development priorities. Some countries used strategic planning approaches in helping identify and prioritize adaptation needs.

The experience of NAPA preparation process from other Pacific island countries showed that the assessment of vulnerability and adaptation on various sectors was based on participatory rapid assessment, community, village or island-wide consultations, and climate change vulnerability and adaptation assessment on each or some of the sectors. Participatory rapid assessment involved the preparation of sectoral reports by sectoral experts. The sectoral reports provided input to the preparation of a national synthesis report. The synthesis report was used as a basis for consultations to identify most urgent and immediate needs for adaptation. The community, village and island-wide consultations process involved the use of or consultation with traditional community/village leadership or authority as well as women and youth groups. Vulnerability and adaptation assessment process involved the use of modelling approaches and frameworks which included climate change and sea-level rise scenarios. Much of this information was taken from the V&A assessments that were conducted as part of the preparation of initial national communications.

### ***6.1 NAPA Inception***

The preparation of NAPA began with the Inception Workshop to kick-off the NAPA process. The focus of the inception workshop was to introduce the project to the key stakeholders and to agree on the strategy for implementation of relevant activities. The workshop helped mobilize the expertise, skills and knowledge for NAPA process as well as identify areas that would require capacity-building and training. The workshop therefore achieved the following:

- a) Introduce the NAPA project and the process for its preparation,
- b) Provide opportunity for key stakeholders to provide input to NAPA process,
- c) Agreement on the management and institutional arrangements,
- d) Establish multi-disciplinary NAPA Teams
- e) Agreement on working arrangements, work plan and budget
- f) Adoption of the structure of NAPA sectoral reports

g) Identify needs for capacity-building and training

Following the closure of the Inception workshop NAPA Team training was conducted to assist NAPA Teams in carrying out the various tasks relating to NAPA preparation. The training was based on learning-by-doing approach wherein participants carried out vulnerability analysis using various vulnerability and adaptation assessment frameworks; synthesis of information on adverse effects of climate change and coping strategies; participatory assessment of vulnerability to current climate variability and extreme weather events, and assess where climate change is causing increases in associated risks; identification of key climate change adaptation measures; identification and prioritization of country-driven criteria for selecting priority activities to address needs arising from the adverse effects of climate change; development of proposals for priority activities to address needs arising from the adverse effects of climate change and preparation of NAPA document following a structure set out in the NAPA guidelines.

After the training one of the first tasks was to develop a synthesis of information on adverse effects of climate change and coping strategies in each of the vulnerable sectors. The sectoral assessments were conducted by respective sectoral teams led by its team leader following and agreed outline and/or structure. These sectoral synthesis reports were subjected to a review process through a national workshop. The results of the sectoral synthesis were integrated into one national synthesis report (SR). The SR covers key vulnerabilities, impacts and adaptation that are currently being carried out in various sectors including agriculture, water resources, health, energy, mining, education, training, public awareness and information, waste management, tourism, environment and forestry. Other sectors which did not have a final draft include fisheries and marine resources, infrastructure development, and human settlement.

NAPA Team also carried out vulnerability analysis by identifying the major climate hazards, where they occur, current trends, ranges of potential changes, and location of their occurrence and adverse impacts these climate hazards have in the country. From the vulnerability analysis key vulnerabilities identified in the Solomon Islands include tropical cyclones, sea-level rise, drought, flooding, storm surges, high temperatures, fires, heavy and high intensity rainfalls and coastal erosion/flooding. These climatic hazards have affected agriculture, water resources, human settlements, human health, fisheries and marine resources, biodiversity (coral reefs), livestock, forests, and infrastructure (roads/bridges, buildings). It should be pointed out that climate impacts do and will differ for different people, sectors, in different areas, and at different times. The differences

occur because of differences in climatic shocks and stresses, environmental, economic and social factors, livelihoods and capacity to adapt.

Potential data sources of information on vulnerability can be sourced from various sources within and outside the country. These sources may include: sectoral analyses completed by various government agencies; local vulnerability studies undertaken by NGOs, UN agencies, and other organizations, academic studies on vulnerability to climate stress, livelihood issues, climate change impacts, or other relevant areas; socio-economic data on disaster impacts, etc; and the national communications<sup>11</sup> on climate change.

One of the easiest ways of vulnerability analysis is by way of identification and categorization of certain livelihood groups as highly vulnerable to a particular hazard or a number of hazards within a country or a region. A map can be produced to show location of people engaged in this activity and areas where these hazards occur, or by simply developing a table containing exposure units, types of threats, locations and any other information that may help in either categorizing vulnerable groups or identification of vulnerable areas/regions.

With respect to the question of responses for each vulnerable group or hazard, these can vary among different groups and hazards. For example actions to help coastal villages adapt to rising sea levels will be very different from adaptation by inland farmers to floods. Therefore, prioritizing and deciding which actions are the most urgent to pursue as a NAPA projects are judgments that must be documented by NAPA Team.

A group exercise was designed to help participants understand not only the processes of vulnerability analysis but also to identify current risks and hazards which would also guide the process of identifying vulnerable groups sectors and resources, taking into consideration current climate risks, and potential for increased resiliency and adaptive capacities as well as the identification of urgent and immediate needs for adaptation. The group exercise was based on hazards table developed in a previous exercise. Based on the hazards table the groups were asked to develop exposure units table and narratives on coping, recovery and adaptations. The exercise was found to be very useful and instructive for many of the participants who had not had any pervious experience in carrying out vulnerability analysis.

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<sup>11</sup> National Communications under the UNFCCC are prepared by each country and contain an analysis of vulnerability and assessment of adaptation options, measures and strategies. Solomon Islands has completed and submitted its initial communication in 2004 and is now in the process of preparing its second national communication.

The training of NAPA Team on the NAPA process helped facilitate the preparation of sectoral assessments which were later compiled into a national synthesis upon which further consultations and meetings were conducted in the communities and/or villages.

## **6.2 *Implementation Arrangements***

The workshop included a discussion on the implementation arrangements of the NAPA process including the management and implementation of the NAPA preparation. United Nations Development Programme (UNDP), as an implementing agency of the GEF, will implement the project. The executing agency of the project is then Ministry of Communications, Aviation and Meteorology through the Solomon Islands Meteorological Services (SIMS). The NAPA Coordinator was installed and placed at the office provided by the SIMS. The NAPA Coordinator was assisted by a Project Assistant in managing the day-to-day operations and activities as well as reporting.

In terms of project management the project applied the UNDP procedures relating to nationally-executed projects. This meant that NAPA coordinator was responsible for the day-to-day operations of the NAPA implementation and also all reporting which was documented and submitted to UNDP on timeframe as outlined in the UNDP manual. NAPA coordinator provided the terms of reference and engaged the services of working groups or NAPA sectoral teams and consultants, in consultation with the Director of Meteorological Services and UNDP-Honiara, to undertake various activities in the preparation of NAPA. The functions of the Director of SIMS relating to the NAPA process have since been transferred to the Director of the Climate Change Division, Ministry of Environment, Conservation and Meteorology (MECM).

The discussions stressed the need for effective coordination of activities with strong implementation and institutional arrangements at the national level. This would ensure that the NAPA process is integrated into the government and development agendas. It was noted that one of the main objectives of the NAPA process is to facilitate the integration of urgent and immediate needs for adaptation to climate change into economic and development planning at the national level.

## **6.3 *Institutional Arrangements***

Strong institutional arrangement for NAPA preparation was considered necessary for effective implementation of the various activities in a timely

manner. Such arrangement also contributed to dealing with the challenges and opportunities for the implementation of the Convention and also on how the NAPA process could respond to dealing with a myriad of urgent and immediate needs relating to the adverse impacts of climate variability and change in the Solomon Islands. The following organigram shows institutional arrangement for NAPA preparation.

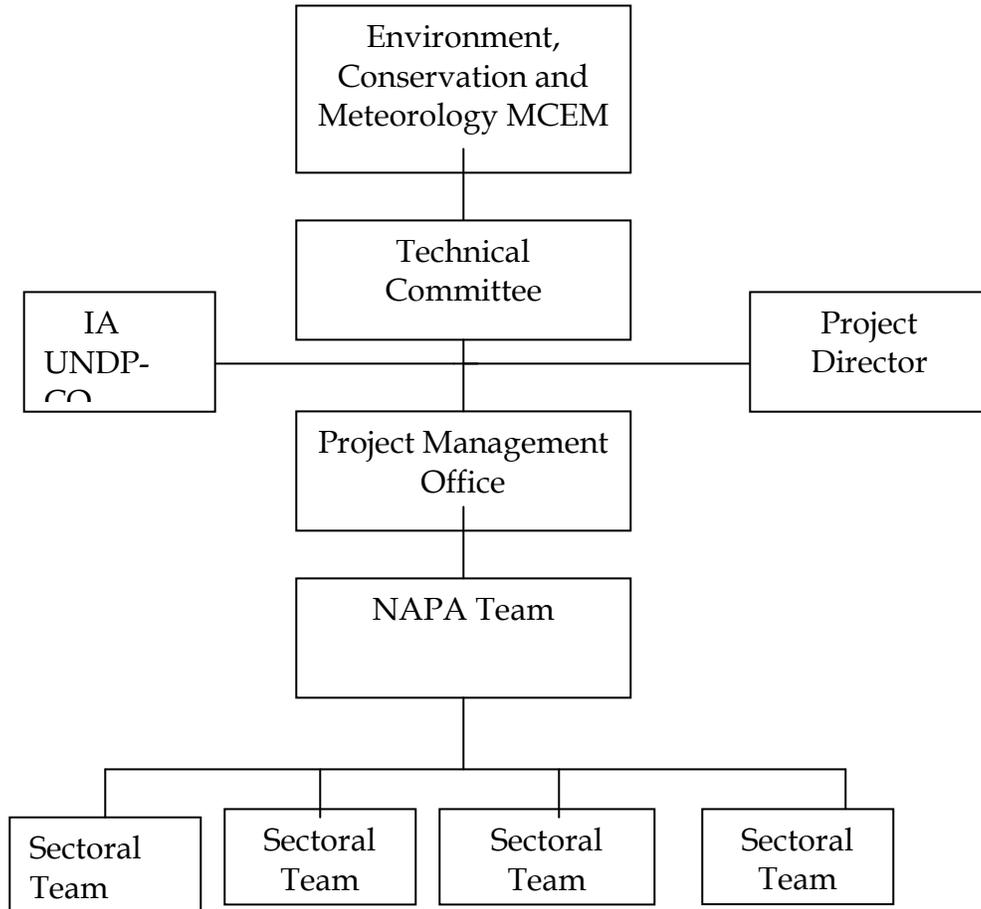


Figure 10: Organigram of NAPA Process showing management and institutional arrangements.

#### 6.4 *Linking the NAPA process with development planning: The role of NAPA Team*

Given that Solomon Islands has had experience with working with a national climate change country team for the preparation of its initial national communication under the UNFCCC, the project benefited greatly from NAPA team who had a critical role in ensuring that all elements of the NAPA process were implemented in a timely and cost-effective manner as well as ensuring that technical studies that were undertaken are appropriate for addressing relevant policy questions.

The formation of NAPA teams included the representation of sectors, communities/villages, national, provincial and local/community governments, non-government and community-based organisations. Based on the merits and relevance of various organisations, institutions and agencies the NAPA Team included the following:

- a) Agriculture
- b) Infrastructure Development
- c) Water Resources
- d) Fisheries
- e) National Disaster Management Office
- f) Health
- g) Environment
- h) Energy
- i) Mines
- j) Tourism
- k) Forests
- l) Trade and Industry
- m) Solomon Islands Red Cross
- n) The Nature Conservancy (TNC)- Solomon Islands Programme
- o) Kastom Gaden Association
- p) National Council of Women
- q) Live and Learn -Solomon Islands
- r) OXFAM - Solomon Islands
- s) World Vision - Solomon Islands
- t) Environmental Concerns Action Network Solomon Islands
- u) WWF-Solomon Islands
- v) Curriculum Development Center
- w) Solomon Islands Locally-Managed Marine Areas

NAPA preparation process involved key stakeholders through a country-team approach. Thus key stakeholders were engaged at the very early stages of project development; i.e. those involved in the project development phase continued to be involved in the NAPA preparation and implementation process. The NAPA process also involved relevant government institutions, agencies, ministries and departments as well as relevant NGOs (see list above). Inputs from key

stakeholders and others were continuously sought through workshops and meetings with documentation and follow-up.

With respect to identification of urgent and immediate needs for adaptation, Solomon Islands focused on island and community scale assessments using bottom-up approaches.

For the effective management of the NAPA process national experts were engaged to carry out set tasks/activities in a timely and cost-effective manner. Many experts often worked as public servants and their engagement for various tasks/activities often went beyond their normal salaried jobs. It was therefore necessary to compensate the experts as part of the cost of project management.

A number of lessons can be highlighted, as experienced from NAPA preparation process:

- a) There was a strong institutional coordination and cooperation among key stakeholders which contributed to the effective management of the NAPA process at the national level,
- b) Clarity over roles and responsibilities of key stakeholders in the NAPA process was significant for the NAPA process,
- c) A country-team approach through NAPA Team ensured that the NAPA process was implemented in a timely and cost-effective manner,
- d) Increasing the visibility and heightening the awareness of NAPA process at the political/policy level and with public at large still remains a concern,
- e) Enhancing and/or improving capacities (i.e. institutional) and capabilities (i.e. individuals) through targeted training and capacity-building in support of the preparation of NAPA was important.

## ***6.5 Methodologies and Tools for NAPA Process***

The UNFCCC guidelines NAPA provide good guidance on what elements of information generated from NAPA process should be included in the NAPA. NAPA process can be summarized as follows:

- a) Build multidisciplinary NAPA teams
- b) Define goals and criteria, review existing policies and identify synergies
- c) Synthesize available information and conduct a participatory assessment to identify urgent and immediate adaptation options
- d) Select priority adaptation needs
- e) Rank projects and activities

- f) Develop project profiles, integration into national policy frameworks and,
- g) Submit NAPA

The preparation of NAPA was based on the annotated guidelines provided by the LDCs Expert Group. In addition a number of approaches were used to illicit information from various sectors of the country. In the context of Solomon Islands vulnerability and adaptation issues V&A is a critical issue and is considered to be of highest priority and the NAPA process thus provided an excellent basis for generating information and knowledge for national and/or sectoral adaptation policy decisions. Key elements of information reported in the NAPA were outlined as follows: current climatic, socio-economic and natural systems; current vulnerability and adaptation, future risks and adaptation policies, strategies and measures. In terms of adaptation projects consideration should be given to those areas and/or sectors that are of most urgent and immediate priority.

An overview of available methodologies and tools was provided. These methodologies included modeling and participatory approaches. Currently Solomon Islands does not have sufficient climate change modelling capacity and capability and therefore much of the information generated regarding adaptation needs and concerns were based on participatory approaches, literature surveys, initial national communication, sectoral assessment reports, sectoral synthesis, development plans and policies.

With respect to prioritization of adaptation options, a number of methods were available to help in the NAPA process including (i) Cost Effectiveness Analysis which involves the cost of the adaptation measure/strategy, benefits of the adaptation measure which is not always quantifiable, and budget estimate for an adaptation option; (ii) Cost Benefit Analysis which determines optimal use of scarce resources and whether benefits outweigh costs (leading to implementation) and quantification of both the costs and benefits. The third approach or method is through a multi-criteria analysis which requires defining a problem and objective of adaptation intervention, criteria used to measure effects, alternative adaptation intervention and estimation of costs of effects. The multi-criteria analysis (MCA) has been widely used by many LDCs to prioritize their adaptation options, measures and strategies in their NAPA processes.

The prioritization of adaptation options were carried out using a set of country-driven criteria. These criteria were also used in the consultation process to identify adaptation needs and concerns. The following criteria was used to prioritize adaptation needs and options:

1. Severity of adverse effects and the underlying vulnerability

2. Urgency
3. Complementary approach: with existing projects, national development efforts, multilateral environmental agreements and that achieve sustainable development goals - (poverty reduction)
4. Culturally acceptable and owned by those affected
5. Cost-effectiveness, feasibility and viability
6. Increases community resilience to climate change and improves livelihoods and income generation
7. Enhances adaptive capacity of communities and sectors to climate change
8. Equity - gender and resources
9. Is sustainable in the long-term

These criteria were applied to each of the needs identified through the consultation process and a workshop on NAPA synthesis. Each of the prioritised options was evaluated through the disaster risk management framework. The results of the risk analysis are contained in Annex 1.

## ***6.6 Presentation of Results***

The final list of prioritised adaptation options includes agriculture and food security, water supply and sanitation, human Health, human settlements, fisheries and marine resources, coastal protection, infrastructure, waste management, tourism and education, awareness and information. After having agreed to the final list of priorities for adaptation a ranking procedure was applied to determine the most important sector for adaptation and the least important sector for adaptation.

Regular ranking were used by NAPA Team to assign each according to a five-point scale ranging between 1 to 5 with 5 being the most important (see section on prioritization for more details). Rating was also applied to each of the ranked sectors ranging from 1 to 10 with higher numbers indicating greater importance. These were calculated to derive weights for each sector with combined weights indicating the relative importance of the sector with respect to climate change adaptation. The results indicate that building resilience in agriculture and improving food security in Solomon Islands is extremely important for climate change adaptation in Solomon Islands. This is followed by water supply and sanitation, education, awareness and information, human settlements; human health; waste management; coastal zones; fisheries and marine resources; infrastructure; and tourism. The first five prioritised sectors (i.e. agriculture and food security; water supply and sanitation; education, awareness and

information; human settlements; human health) all had combined weights of over 10 while the rest scored less than 10.

## CHAPTER 7. IMPLEMENTATION STRATEGY

### 7.1 NAPA

At present much of the national climate change activities have been so far driven by support received through regional and international mechanisms. At the country level, the establishment and adoption of a policy framework which outlines the country's perspective with regard to climate change and UNFCCC and how they relate to the country's economy and national developments plans; the commitments and opportunities available under the Convention; and the country's national policies, measures and actions to implement the Convention could be a step forward to the formation of a structured process to properly address climate change and its adverse effects at the national level.

The policy document in the form a National Implementation Strategy (NIS) would recommend to the government on areas such as the establishment of an effective institutional framework for coordinating policy development, planning, and the identification of needs relevant to the implementation of the UNFCCC; and to recommend any other future activities and projects that are appropriate and pertinent to the implementation of the Convention.

In recognition of the importance of the climate change as a development issue the CNURA government has established a MECM. One of the Divisions within the MECM is the newly established Climate Change Division (CCD). The Division is responsible for:

- a) Raising awareness and increasing understanding of policymakers in both government and non-government organisations and the general public about climate change and UNFCCC and build consensus on national responses;
- b) Facilitating, coordinating and implementing climate change enabling activities such as preparation and submission of NAPA and the second national communication;
- c) Establishing a framework for integrating climate change considerations into national development planning and relevant sectoral policies;
- d) Establishing procedures and criteria for identifying and assessing climate change projects that meet national needs and for submitting them to GEF and other potential donors.

All climate change programmes, projects and activities are being coordinated by the CCD. The CCD has three full-time staff and four project staff who carry out tasks/activities relating to climate change projects, programmes and activities in the country such as the preparation of climate change enabling activities (e.g. SNC and NAPA). The CCD also serves as a secretariat for the Technical Committee (TeCOM).

The TeCOM was established to oversee all climate change programmes, projects and activities in the country. It provides scientific, technical and policy guidance to the preparation of climate change adaptation and mitigation project proposals and implementation thereof. The membership of TeCOM, as outlined Chapter VI, represents key stakeholders including non-government organisations and the private sector. All reporting will be through the TeCOM.

The CCD, headed by the Director, will continue to provide overall coordination of all climate change-related activities. Thus, adaptation projects within the priority sectors (see project profiles) will be managed and implemented by appropriate ministry and/or department as part of its statutory mandate. This will ensure incorporation of climate change issues into sectoral and national planning processes.

In addition to the execution and implementation of the NAPA projects, MECM will host at least two full-time staff that will provide the day-to-day administration of the adaptation projects and supported by other responsible line agencies. These two full-time staff will be part of the Project Management Team (PMT) which will be directly responsible to the Director in the respective department or agency.

## ***7.2 Policy Integration***

One of the key outcomes of NAPA is to encourage the integration of climate change issues into sectoral policies and national development planning. The most effective way in which this can be achieved is through the involvement and participation of the various stakeholders representing various sectors and line ministries of the government. NAPA preparation process has shown that collaboration and cooperation through a country team approach will heighten the chances for national integration. NAPA has provided the impetus for putting climate change issues on the development agenda for Solomon Islands and will in no doubt contribute immensely to the impending development of a climate change policy for the country. The implementation of NAPA over the long term will be embedded in such a policy centered on people, livelihood, environment and development.

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## ANNEX 1- Adaptation Options

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date/line	Expected Output	Evaluation
<b>1. AGRICULTURE</b>						
Value adding to crops to avoid wastage through rotting	<ol style="list-style-type: none"> <li>Build capacity of communities on value adding</li> <li>Carry out small scale value adding (food processing) activities</li> </ol>	Food processing equipments, Technical staff, logistics, Preparation of training materials on food processing , Food crop produce	MAL NGO's (Civil Societies) Private Sectors	December 2008 to June 2009	Training materials produced Small scale processing practiced	Monitoring Reports
Application of soil correction medium	<ol style="list-style-type: none"> <li>Carry out soil analysis to determine toxic substance</li> <li>Acquire correction medium (ie fertilizer or introduce crop sinks)</li> </ol>	Soil Analytical Lab Soil testing equipments Soil testing Kits Technical staff Fertilizer Source of sink	MAL/Research SICHE Communities NGO's (Civil Societies) Donors	2009	Soil analytical lab established Equipments & facilities procured Fertilizers acquired Sources of sink identified and established	Monitoring Reports
Salt tolerant crops	<ol style="list-style-type: none"> <li>Identify local crops tolerant to saline conditions</li> <li>Mass propagation of soil tolerant crops</li> <li>Distribution of local crops</li> <li>Introduce crops (from outside Solomon islands) that adapt to saline conditions</li> <li>Breed crops that will withstand saline conditions</li> <li>Carry out atoll adaptive research</li> </ol>	Human Resources Propagating structures Tools, Transport Funds, Planting materials, Traditional Knowledge, Breeding Laboratory Equipments, Staff	MAL NGO's Communities Researchers Atoll farming Information	2009	Salt tolerant crops identified Mass propagated and distributed to affected communities Atoll adaptive research carried out	Monitoring Equipments
Provide water	<ol style="list-style-type: none"> <li>Establish water system</li> <li>Water harvesting structures</li> </ol>	Irrigation pipes Water tanks Water Reservoirs Water pumps	MAL, NGO's Farmers/Local communities Equipment Suppliers, RWSS	2010	Irrigation established Water reservoirs established Harvesting structures established	Monitoring Equipments
Water Tolerant Crops	<ol style="list-style-type: none"> <li>Identify crops that can withstand water logged areas</li> <li>Mass Propagation of Water tolerant crops</li> <li>Distribution to water logged</li> </ol>	Human Resource Planting material Traditional Knowledge Tools , Logistics Technical experts Quarantine	MAL Research /Extension NGO's Researchers Communities Quarantine MECM (MET Division)	2009	Crop identified, mass propagated & distributed  Materials acquired from outside	Monitoring Equipments

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date	Expected Output	Evaluation
Early warning system	<ol style="list-style-type: none"> <li>1. areas</li> <li>2. Acquire planting material from outside SI</li> <li>3. Mass propagation and distribution</li> <li>4. Establish early warning system</li> <li>5. Acquire equipments</li> <li>6. Establish procedures &amp; drills</li> <li>7. Establish coordinating body</li> <li>8. Identification of local and traditional knowledge on climate indicators</li> </ol>	import permit, Technical advise, Equipments & funds, infrastructure Staff, Manuals on procedures & drills	MAL Farmers	2008	Early warning systems established Equipments bought Networking established Manuals and drills produced	Monitoring Equipments
Tolerant crops that can withstand rising temperatures	<ol style="list-style-type: none"> <li>1. Identify crops that with stand high heat</li> <li>2. Mass propagation</li> <li>3. Distribution to communities</li> <li>4. Acquire planting material from outside</li> <li>5. Adopted research</li> <li>6. Mass propagation</li> <li>7. Distribution to communities</li> </ol>	Propagation structures Tools Funds Staff Plant material	MAL Research / Extension Researchers NGO's Communities	2010	Crops identified, propagated & distributed to farmers Community adoption of technology Plant materials acquired	Monitoring Equipments
Breeding for tolerance to increased temperatures	<ol style="list-style-type: none"> <li>1. Import crops proved to withstand high temperatures and breed with local crops for suitable characteristics favorable to SI conditions</li> </ol>	Staff, Funds, Planting Material, Plant Propagation structures & facilities, Quarantine import permits, Intellectual knowledge	MAL/Research & Extension NGO's Researchers Communities	2010		Monitoring Equipments
<b>2. TRADE &amp; INDUSTRIES</b>						
Crops, commodities, properties covered by insurance	<ol style="list-style-type: none"> <li>1. Establish insurance Policy</li> <li>2. Negotiate Premium</li> <li>3. Pay insurance cover</li> </ol>	Insurance expertise Insurance Companies Funds for premium	Companies Govt Agencies Insurance Companies	6-12 months	Insurance policy established Funds allocated in annual budget Insurance paid	Policy Budget Allocation Payment made Payment received
Management and employees aware and practice disaster drills	<ol style="list-style-type: none"> <li>1. Establish early warning system</li> <li>2. Establish Linkages</li> <li>3. Disaster drills</li> <li>4. Staff awareness &amp; drills established</li> </ol>	Early warning communication equipments Drill manual trainers	MECM/ MET Division NDMO Personal Managers	6-12 months	Early warning network system established Drill manuals available Communicat	Networking system Equipments Manuals No. of Drills carried

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Dateline	Expected Output	Evaluation
					ion equipments Regular drills	
<b>3. WATER SECTOR</b>						
Water sector planning and management	<ol style="list-style-type: none"> <li>Appropriate guidelines for water supply development in rural areas</li> <li>Awareness and education</li> <li>Policies and legislation</li> </ol>	Human Resource Funding Transportation	WRD.(MMERE), RWSS, SIWA, NGO's Municipal Authorities	Now	Adequate legislation policy and sector plan for water resources sector management and development .	Report to relevant authorities on Progress (e.g Water Com)
Appropriate infrastructure design guidelines	<ol style="list-style-type: none"> <li>Appropriate design guidelines</li> <li>Training</li> </ol>	Trained manpower Funding Community support	WRD (MMERE) SIWA, RWSS	As Appropriate	Improve resilience for water infrastructure.	Monitoring and Assessment.
Rainwater harvesting	<ol style="list-style-type: none"> <li>Rainwater harvesting technology</li> <li>Awareness and education</li> <li>Water conservation program</li> </ol>	Trained manpower Funding Community Support	WRD (MMERE) RWSS, SIWA	Now	Appropriate technology for sustainable water availability for vulnerable areas.	Continuous monitoring and assessment.
Resettlement of communities	<ol style="list-style-type: none"> <li>Awareness and education</li> <li>Land acquisition</li> </ol>	Funding Community Support Awareness Programs	WRD.MMERE AID DONORS SIG CHURCHES	As Appropriate	Relocate vulnerable communities .	Monitor and assess current situation and possible outcomes.
Water conservation	<ol style="list-style-type: none"> <li>Water use efficiency plan</li> <li>Water conservation practices</li> <li>Awareness and education</li> <li>Water resources monitoring</li> </ol>	Human Resource Training Storage facilities Community Support	WRD, (MMERE) SIWA, RWSS NGO's Municipal Authorities	Now	On going water conservation, water conservation practices.	Continuous monitoring and assessment.
Water treatment	<ol style="list-style-type: none"> <li>Awareness and education</li> <li>Water quality management</li> <li>Water treatment technology</li> </ol>	Trained Manpower Funding Community Support	SIWA, AID DONORS, SIG	As Appropriate	Improve water quality	Continuous monitoring and assessment.
Guidelines for water supply development	<ol style="list-style-type: none"> <li>Awareness and education</li> <li>Water resources assessment</li> <li>Water resources monitoring</li> </ol>	Man power training Community Support	WRD (MMERE) SIWA	Now	Successful implementation of water supply installation.	Final Assessment of water use.
<b>4. HEALTH SECTOR</b>						
Increase bed-net coverage to areas affected by extreme	<ol style="list-style-type: none"> <li>Do survey to identify areas prone to extreme flooding</li> </ol>	- Funds for survey and bednet stock	MHMS/VBD CP, SIMTRI, Ministry of Lands, NGO	now	Locality and population prone to extreme	Report

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date	Expected Output	Evaluation
flooding	2. Availability of emergency bednet stock	- Logistics			flooding in each province Availability of Bednet stock	
Health awareness programs focusing on the impacts of extreme flooding for areas prone to be affected	1. Research to determine and understand parasites, bacteria and viruses likely to cause diseases outbreaks after extreme flooding. 2. Awareness programs based on facts obtained from research 3. Develop a training program with SIMTRI to train personnel involving in health awareness and related programs.	- Funds for research - Diagnostic laboratory reagents and equipments - Laboratories in major centers -Funds for awareness programs	-VBDCP, -SIMTRI, -Medical laboratories, Public Health Laboratories, Health Promotion Division TB/Leprosy unit Private & Mission hospitals, NGO	now	confirmation of parasites, bacteria and viruses likely to pose disease outbreaks completion of awareness programs to all villages identified to be affected by extreme flooding Development of training program with SIMTRI	report
Proper sanitation for communities in atolls and low lying areas that storm surge could enhance spread of harmful diseases/parasites	1. Research on appropriate modern toilets suited for such situations 2. trials with the new toilets 3. Build modern toilets for communities	- Funds for research - Funds for construction of toilets	- Environmental Health division -NGO	now	Design of appropriate toilets Number of toilets constructed	Report
De-worming of communities in atolls and low lying areas	1. De-worming activities	- Funds for drugs - operation cost for annual deworming programs	Maternal health Child	now	Number of communities dewarmed. Number of people dewarmed	report
Relocation of communities in atolls and low lying areas prone to storm surge, to higher grounds and promote building on stilts	1. Do survey to identify areas prone to storm surge 2. health awareness programs to identified areas 3. Relocation of identified communities	- Funds for surveys, awareness and relocation of communities - logistics	-SIMTRI -Medical lab. -Ministry of lands -Disaster council -NGO	2009 - 2010	Completion of surveys Awareness in prone communities Construction of appropriate sanitations	report
Improve sanitation in communities living in low lying areas and atolls prone to storm surge	1. Do survey to identify areas prone to storm surge 2. health awareness programs to identified areas	- Funds for development and production of appropriate sanitation technologies	SIMTRI Environmental Health Medical lab. Ministry of lands, NGO Disaster	2009 - 2010	completion of surveys awareness in prone communities construction of	report

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date	Expected Output	Evaluation
	<ol style="list-style-type: none"> <li>3. Research on appropriate sanitation</li> <li>4. build appropriate sanitations</li> </ol>		council		appropriate sanitations	
Relocate health facilities located in areas prone to extreme storm surge, to higher grounds	<ol style="list-style-type: none"> <li>1. Do survey to identify facilities located in areas prone to storm surge</li> <li>2. relocate some facilities on higher grounds</li> <li>3. uplift some facilities</li> </ol>	<ul style="list-style-type: none"> <li>- funds for surveys</li> <li>- funds for relocation and uplifting of facilities</li> </ul>	MHMS, Ministry of works, NGO, Ministry of lands	2009 - 2010	Facilities relocated Facilities uplifted	report
Introduce vitamin supplement programs to communities prone to extreme storm surge	<ol style="list-style-type: none"> <li>1. Do survey to identify areas prone to storm surge and vitamin deficiencies they are likely to be affected with.</li> <li>2. research on expected periods of storm surges</li> <li>3. health awareness programs to identified areas</li> <li>4. Acquiring of vitamin tablets</li> <li>5. implementation of vitamin supplement programs</li> </ol>	<ul style="list-style-type: none"> <li>- funds for surveys</li> <li>- Vitamin tablets</li> <li>- Funds for implementation</li> </ul>	<ul style="list-style-type: none"> <li>- MHMS</li> <li>- Health Nutrition Unit</li> <li>- Maternal Child Health</li> <li>-NGO</li> </ul>	2009 - 2009 - 2010	Completion of survey and research report Availability of vitamin stocks Distribution of tablets.	Reports
Increase food production by introducing saline resistant crops	<ol style="list-style-type: none"> <li>1. Do survey to identify areas prone to storm surge</li> <li>2. Research on edible plants/vegetables resistant to high salinity</li> <li>3. Awareness on appropriate plants</li> </ol>	<ul style="list-style-type: none"> <li>- Funds for surveys</li> <li>- Funds for research</li> <li>-Funds for awareness</li> </ul>	-Ministry of agriculture -MHMS -NGO	- 2009 - 2010- 2011	Identification of plants resistant to salinity Awareness message received	Report
Avoid over crowding in safe havens during cyclones	<ol style="list-style-type: none"> <li>1. Public Health Training of personnel participating in the emergency process</li> </ol>	<ul style="list-style-type: none"> <li>- Funds for training</li> <li>- Development of training program</li> </ul>	MHMS SIMTRI TB/Leprosy Disease control NGO	- 2009- 2011	Development of 'Health and Climate Change' course Personnel with a good health background in institutions participating in emergency activities	Graduation

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Dateline	Expected Output	Evaluation
Health awareness on dangers pose during and after cyclones	<ol style="list-style-type: none"> <li>2. Public Health Training of personnel participating in the emergency process</li> <li>3. Awareness programs to communities</li> </ol>	<ul style="list-style-type: none"> <li>- Funds for training</li> <li>- Development of training program</li> </ul>	<ul style="list-style-type: none"> <li>-MHMS</li> <li>-SIMTRI</li> <li>-TB/Leprosy</li> <li>-Public Health Divisions</li> <li>-NGO</li> <li>-Climate Change</li> </ul>	- 2009	<p>Development of 'Health and Climate Change' course</p> <p>Personnel with a good health background in institutions participating in emergency activities</p> <p>Coverage of awareness programs</p>	reports
Emergency units such as sanitation units and bednets after cyclones	<ol style="list-style-type: none"> <li>1. construction of a emergency warehouse</li> <li>2. stocking of emergency units for sanitation and malaria (bednets)</li> </ol>	<ul style="list-style-type: none"> <li>-funds for construction of warehouse</li> <li>-funds for sanitation kits and bednets</li> </ul>	<ul style="list-style-type: none"> <li>-MHMS</li> <li>-VBDCP</li> <li>- Environmental Health, NGO, NDMO</li> </ul>	2009	<p>Warehouse for stocking of emergency kits/units</p> <p>A stocked warehouse with emergency kits/units</p>	Reports
Awareness training on drought related health issues	<ol style="list-style-type: none"> <li>1. Public Health Training of personnel participating in the emergency process including droughts</li> </ol>	<ul style="list-style-type: none"> <li>- Funds for training</li> <li>- Development of training program</li> </ul>	<ul style="list-style-type: none"> <li>MHMS,</li> <li>SIMTRI,</li> <li>Public Health Divisions,</li> <li>NGO, Climate Change</li> </ul>	- 2009-2011	<p>Development of 'Health and Climate Change' course</p> <p>Personnel with a good health background in institutions participating in emergency activities</p>	-Reports -Graduation
Health awareness on potential dangers posed by high rainfall	<ol style="list-style-type: none"> <li>1. Research on health problems caused by rainfall</li> <li>2. identification of communities more likely to be affected by impacts due to high rainfall, based on guidelines determined by research findings</li> <li>3. amalgamation of meteorology and malaria information system</li> <li>4. Awareness</li> </ol>	<ul style="list-style-type: none"> <li>- Funds for research</li> <li>- Funds for cooperating information systems</li> <li>-Funds for awareness</li> </ul>	<ul style="list-style-type: none"> <li>- SIMTRI</li> <li>-Medical lab</li> <li>- Statistics unit/MHMS</li> <li>-MHMS</li> <li>-Climate Change</li> </ul>	-2009	<p>Availability of knowledge regarding rainfall and health</p> <p>Establishment of an integrated information system between Meteorology and VBDCP</p> <p>Coverage of communities</p>	Reports

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date	Expected Output	Evaluation
	programs to communities based on facts obtained from research					
Proper sanitation in communities more affected by the impact of high rainfall	<ol style="list-style-type: none"> <li>1. Research to the epidemiology and relationship between rainfall and health in regards to proper sanitation</li> <li>2. identification of communities more likely to be affected by impacts due to high rainfall, based on guidelines determined by research findings</li> <li>3. Awareness programs to communities based on facts obtained from research</li> <li>4. Training of community based groups on health risks caused by high rainfall</li> <li>5. Construction of proper sanitation in communities identified</li> </ol>	<ul style="list-style-type: none"> <li>- Funds for research</li> <li>- funds for survey and identification of communities</li> <li>- funds training of community based groups</li> <li>- Funds for training of personnel participating in programs</li> <li>- Funds for sanitation constructions</li> </ul>	<ul style="list-style-type: none"> <li>- Environmental Health</li> <li>-SIMTRI Medical Lab</li> <li>- Climate Change</li> <li>- Community based groups</li> <li>-NGO</li> </ul>	2009	Availability of knowledge regarding rainfall and health Coverage of awareness to communities	Reports
Increased bednet distribution and malaria control activities after high rainfall seasons	<ol style="list-style-type: none"> <li>1. identify communities more affected by the impact of rainfall</li> <li>2. intensify bednet distribution in expected rainfall periods</li> <li>3. Promote women faith groups to distribute bednets</li> <li>4. acquire bednets</li> </ol>	<ul style="list-style-type: none"> <li>- Research to determine guidelines to identify villages more affected by high rainfall in all the provinces</li> <li>- Bednets</li> <li>- funds for distribution of bednets</li> </ul>	<ul style="list-style-type: none"> <li>-SIMTRI</li> <li>-VBDCP</li> <li>-Climate Change</li> </ul>	2009	Training of personnel Research information produced High coverage of prioritized communities with malaria control activities Involvement of women groups	Evaluation Reports
Training of health personnel on strategic planning to use during high rainfall periods	<ol style="list-style-type: none"> <li>1. Training of health personnel (VBDCP) and personnel participating in malaria control activities on “ Applied parasitology and entomology in</li> </ol>	<ul style="list-style-type: none"> <li>- funds for training for all provinces</li> <li>- production of materials</li> <li>- integrate meteorology and VBDCP information systems</li> </ul>	<ul style="list-style-type: none"> <li>-SIMTRI</li> <li>-VBDCP</li> <li>-Climate Change</li> </ul>	2009	Completion of training for all provinces Establishment of and integrated information system Improved	Evaluation Reports

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date	Expected Output	Evaluation
	2. malaria control" amalgamation of meteorology and malaria information system				strategic planning reduction of malaria during	
Health awareness on malnutrition and related diseases due to high rainfall	<ol style="list-style-type: none"> <li>1. Research to the epidemiology and relationship between rainfall and health in regards to malnutrition and related diseases</li> <li>2. Research on wet resistant crops/vegetables</li> <li>3. Input of information into the public health training program</li> <li>4. Training of health personnel attending malnutrition</li> <li>5. training of communities</li> </ol>	-Funds for research and training	-SIMTRI -Nutritional Health - Health statistics unit -Maternal Child Health - Ministry of Agriculture	2009	Research findings released Number of trainings for health personnel Number of awareness of communities	Evaluation Reports
Provide bed nets and malaria control activities to communities living in higher altitude as temperature rises to higher altitudes	<ol style="list-style-type: none"> <li>1. Survey communities in high altitudes prone to be affected</li> <li>2. distribution of bednets to communities living in non malarious areas in the high altitudes</li> </ol>	- logistics	- VBDCP	2009	Coverage of communities identified	Evaluation Reports
Capacity building on epidemic predictions for viral and bacterial diseases for institutional strengthening	<p>Research on models and strategies to predict and prevent epidemics</p> <ol style="list-style-type: none"> <li>1. Awareness programs based on findings from research</li> <li>2. input into the public health training program</li> </ol>	- Funds for research -Funds for research	-SIMTRI -Health statistics -MHMS	2009	Development of guidelines to predict epidemics of respective diseases Development of strategies to prevent epidemics Community awareness through media	Evaluation Report
<b>5. Education</b>						
Vulnerability Assessment	<ol style="list-style-type: none"> <li>1. Consultation</li> <li>2. PRA</li> </ol>	Technical experts, Financial support, Logistics, equipment & tools,	MoL, Prov Govt, MPG, NDMO, CCO, MECM, relevant stakeholders,	3-6 mnths	Verifications of data of potential activities,	Dir. Observation Questionnaire Field visits

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Dateline	Expected Output	Evaluation
Implement minimum design guidelines for school buildings	<ol style="list-style-type: none"> <li>1. Consult with technical experts on minimum requirements,</li> <li>2. Research and data gathering,</li> <li>3. develop design guideline</li> </ol>	Technical experts, financial support, equipment and instruments, logistic support	MEHRD, MID, other relevant authorities including development partners	6-12 mnths	National design guideline for class buildings	Questionnaire Completion of guidelines
<b>6 Waste Management</b>						
Vulnerability Assessment (similar to Health sector)	<ol style="list-style-type: none"> <li>1. Consultation</li> </ol>	Technical experts, Financial support, Logistics, equipment & tools,	MoL, Prov Govt, MPG, NDMO, CCO, MECM, HCC, relevant stakeholders,	3-6 mnths	Waste audit, waste segregation, verification of data on potential activities,	Dir. Observation Field visits Questionnaire
Trap methane gas for household use as a source of Biofuel	<ol style="list-style-type: none"> <li>1. Designate disposal site,</li> <li>2. construct engineered land-fill,</li> <li>3. delegate authority to responsible agencies</li> <li>4. Institute pilot study on convert biodegradable wastes to extract methane for cooking</li> </ol>	Technical experts, financial support, equipment and tools, logistic support	MECM, MME, HCC, MHMS, MID,	12-24 mnths	Reduce indiscriminate disposal of waste, Use methane as biofuel for domestic and industrial purposes	Field visits Dir. Observation Questionnaire s Lab experiments On-site monitoring of methane generation
<b>7. Human Settlement</b>						
Vulnerability Assessment (similar idea in Health Sector)	<ol style="list-style-type: none"> <li>1. Consultation</li> </ol>	Technical experts, Financial support, Logistics, equipment & tools,	MoL, Prov Govt, MPG, NDMO, CCO, MECM, relevant stakeholders,	3-6 mnths	Verifications of data of potential activities,	Field visits Dir. Observation Questionnaire s
Develop a community fire escape plan of action	<ol style="list-style-type: none"> <li>1. Consult with communities</li> <li>2. education and awareness</li> <li>3. community training on fire management</li> <li>4. Establish fire breaks around communities</li> </ol>	Consultants, logistic support, experts, equipment, finance,	Provincial authorities, Fire department, NDMO	1-3 mnths	Community fire response strategy,	Field visits Dir. Observation Questionnaire s
Relocate settlements	<ol style="list-style-type: none"> <li>1. Consult with relevant authorities,</li> <li>2. Consult with resource owners,</li> <li>3. Consult with people to be re-settled,</li> <li>4. Consult with receiving communities</li> </ol>	Experts, finance, logistic support, building materials, tools, equipment,	MPG, MoL, MPG, Communities,	5- 10 yra	Relocate communities from affected areas,	Field visits Dir. Observation Questionnaire
Construct Sea walls, wave breakers and plant mangrove tree along coastlines	<ol style="list-style-type: none"> <li>1. Use natural stones, and sticks</li> <li>2. Use heavy duty concrete as retaining walls and wave breakers</li> </ol>	Technical experts, Finance, logistics equipments,	MID, MoL, MECM, Provincial Gov't, Communities	3-6 mnths	Sea walls, wave breakers, Newly planted mangrove patches	Field visits Dir. Observation Questionnaire s Proto-type Experiments
<b>8. Mines</b>						
Establish and develop a risk management	<ol style="list-style-type: none"> <li>1. Review and develop appropriate legislation to ensure mining investors</li> </ol>	Technical expertise	Mines Dept, Resources	2009	Harmonize working relationship	On-going

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Dateline	Expected Output	Evaluation
plan and build structures that would withstand tropical cyclones	establish management plans to counter impacts of tropical cyclones	Fund Logistics	owners Investors, Provincial gov'ts		between Responsible Agencies  Reduce vulnerability to infrastructure and people	Review annually
Develop and build additional tailings dam/ponds	<ol style="list-style-type: none"> <li>1. Establish national task force</li> <li>2. Undertake feasibility study to determine geological structure of the area</li> <li>3. Education and awareness</li> <li>4. Consultation and information sharing</li> <li>5. Acquisition of land</li> <li>6. Development of the process</li> <li>7. EIA</li> </ol>	Technical personnel's Fund Logistics	Mines Dept Resources owners Investor Environmental Division Water Resources Dept, NGOs	Prior to production	Harmonize working relationship between Responsible Agencies  Reduce vulnerability to nearby communities and properties	On-going  Review annually
Established dilution system to help reduce amount of chemical concentration	<ol style="list-style-type: none"> <li>1. Establish chemical concentration control system</li> <li>2. Carryout regular concentration assessments</li> <li>3. Collaborative risk assessment from all responsible agencies</li> </ol>	Technical personnel's Fund Logistics	Mines Dept, Resources owners, Investor Environmental Division, Water Resources Dept NGOs	On going	Operation and implementation of monitoring  Low concentration of chemical  Low chemical risk to all stakeholders	On-going  Review annually
Infrastructures built on higher grounds	<ol style="list-style-type: none"> <li>1. Establish national task force</li> <li>2. Undertake feasibility study to determine geological structure of the area</li> <li>3. Education and awareness</li> <li>4. Consultation and information sharing</li> <li>5. Acquisition of land</li> <li>6. Development of the process</li> <li>7. Environment Impact Assessment</li> </ol>		Mines Dept Resources owners Investor Environmental Division Water Resources Dept, NGOs	Prior to production	Harmonize working relationship between Responsible Agencies  Reduce vulnerability to infrastructure and people	On-going  Review annually

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Dateline	Expected Output	Evaluation
Build cyclone proof structures to withstand extreme weather	<ol style="list-style-type: none"> <li>1. Establish national task force</li> <li>2. Undertake feasibility study to determine geological structure of the area</li> <li>3. Education and awareness</li> <li>4. Consultation and information sharing</li> <li>5. Acquisition of land(Explain)</li> <li>6. Development of the process</li> </ol>	<p>Technical personnel's</p> <p>Fund</p> <p>Logistics</p>	Mines Dept Resources owners, Investor Environmental Division, Water Resources Dept NGOs, NDMO	Prior to production	<p>Harmonize working relationship between Responsible Agencies</p> <p>Reduce vulnerability to infrastructure and people</p>	<p>On-going</p> <p>Review annually</p>
<b>9. Forestry</b>						
Ensure harvesting of trees should not be undertaken in places on slopes i.e. beyond 15° elevation , mountain forest and varied topographic areas	<ol style="list-style-type: none"> <li>1. Establish appropriate policies and regulation</li> <li>2. Impose high penalties for breach of regulation</li> <li>3. Promotion and awareness</li> <li>4. Monitoring (Compliance)</li> </ol>	<p>Competent personnel</p> <p>Logistic and support</p>	MoF Resource owners NGO Donors MECM	2008 - 2010	<p>Appropriate legislation enacted</p> <p>Improved knowledge and understanding</p> <p>Better land use and harvesting practices</p> <p>Reduced deforestation on slopes, mountain and varied topographic areas</p>	<p>Continuous monitoring</p> <p>Awareness every qtr</p>
Establish buffer zones and wind breakers	<ol style="list-style-type: none"> <li>1. Survey and inventory</li> <li>2. Demarcation and Mapping</li> <li>3. Monitoring</li> </ol>	<p>Competent personnel</p> <p>Logistic and support</p>	MoF, Resource owners, NGO Donors, MECM	2008 - 2010	<p>Establishment of buffer and windbreaks.</p> <p>Reduce climatic negative impacts to standing forest</p>	Quarterly monitoring
Effective monitoring of best practices e.g. logging code of practises and amendments and improvement of current regulations - legislations, etc....	<ol style="list-style-type: none"> <li>1. Field assessment</li> <li>2. Monitoring (Compliance)</li> <li>3. Review LCOP</li> </ol>	<p>Competent personnel</p> <p>Logistic and support</p>	MoF, Resource owners, NGO, Donors, MECM Min. Lands, Housing and Survey	2008 - 2010		Continuous

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date	Expected Output	Evaluation
Strengthen resource owners reforestation program	<ol style="list-style-type: none"> <li>Education and awareness</li> <li>Consultation and networking</li> <li>Extension and technical services</li> <li>Procurement and distribution of seed and tools</li> <li>Community Reforestation funding scheme</li> </ol>	<p>Competent personnel</p> <p>Logistic and support</p> <p>funding</p>	MoF Resource owners NGO Donors MECM	2008 - 2010	<p>Increase number of trees planted</p> <p>Better forest protection</p>	On going
Introduce best and suitable species (trees)	<ol style="list-style-type: none"> <li>Research and data collection</li> <li>Trials plots</li> <li>Documentation</li> <li>Mass propagation of suitable species</li> <li>Distribution to communities</li> </ol>	<p>Competent personnel</p> <p>Logistic and support</p> <p>Propagation structures</p> <p>Tools</p>	MoF Resource owners NGO Donors MECM	2008 - 2010	<p>Identification of acquisition of most appropriate tree species.</p> <p>Establishment of planting program</p> <p>Natural adaptation of forest to varied climate environment</p>	2009 onwards
Reduce deforestation to allow forest natural adaptation to climatic variations.	<ol style="list-style-type: none"> <li>Establish protection and natural reserve</li> <li>Consultation and awareness</li> </ol>	<p>Competent personnel</p> <p>Logistic and support</p>	MoF Resource owners NGO Donors MECM	2008 - 2010	<p>Minimal disturbances to the Natural state of the Forest.</p> <p>Improved knowledge and understanding on conservation and protection</p>	2009 onwards
<b>10. Energy</b>						
Suitable technology and appropriate engineering works	<ol style="list-style-type: none"> <li>Re-assessment of current power distribution, RET set ups</li> <li>Cyclone proof power distribution lines in urban centres</li> <li>Underground power distribution</li> <li>Human Resource Training</li> <li>Infrastructure design to suit climatic conditions of SI</li> </ol>	<p>TA</p> <p>Materials and equipments</p> <p>Logistic</p>	Energy Div, SIG, SIEA Donors, NDMO	2009 - 2011	<p>Most distribution lines are done underground</p> <p>Distribution lines are able to withstand destructive nature of cyclones and adverse climatic conditions.</p>	Every 6 months

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date/line	Expected Output	Evaluation
Proper management and maintaining of infrastructures	<ol style="list-style-type: none"> <li>1. Management plans are drafted and implemented</li> <li>2. Regular monitoring of structures</li> </ol>	<p>TA</p> <p>Materials and equipments</p> <p>Logistic</p>	TA Materials and equipments Logistic	2009 – 2011	<p>Management plans are drafted and implemented</p> <p>Assessment done</p> <p>Required installation guidelines in place and implemented</p>	Every 6 months
<b>11. Fisheries</b>						
Stockpiling of products (fish) (Specify) to maintain production	<ol style="list-style-type: none"> <li>1. Build and improve storage facilities</li> <li>2. increase labourers</li> </ol>	<p>Manpower</p> <p>Logistic &amp; support</p> <p>Materials/equipment</p>	SIG FFA Investors Res Owners	2008-2010 On-going	<p>Purchase, instalment of equipment and facilities</p> <p>Continuous production</p>	Daily and weekly monitoring
Improved and enforced weather monitoring, information and communication system	<ol style="list-style-type: none"> <li>1. Establish weather monitoring facilities and system (early warning preparedness)</li> <li>2. Revive traditional weather monitoring techniques, knowledge and skills</li> <li>3. Country wide education and awareness programs</li> </ol>	<p>Manpower</p> <p>Logistic &amp; support</p> <p>Materials/equipment</p>	SIG, FFA Investors Res Owners MEHRD, NGOS	2008-2010 On-going	<p>Purchase, instalment of equipment and facilities</p> <p>Operation of system, establishment of database</p>	Daily and weekly monitoring
Fish and marine products monitoring system	<ol style="list-style-type: none"> <li>1. Establish research, monitoring and database equipment in every provinces</li> <li>2. Trained Human Resource</li> <li>3. Knowledge of endangered species (breeding grounds -Turtles)</li> <li>4. Develop and manage a national marine database</li> </ol>	<p>Manpower</p> <p>Logistic &amp; support</p> <p>Materials/equipment</p> <p>Funds</p>	SIG, FFA Investors Res Owners NGOs	2008-2010 On-going	<p>Purchase, instalment of equipment and facilities</p> <p>Operation of system, establishment of database</p>	Daily and weekly monitoring

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Dateline	Expected Output	Evaluation
Sustainable fishing techniques	<ol style="list-style-type: none"> <li>1. Training institutions</li> <li>2. Revive traditional harvesting techniques</li> <li>3. Share traditional fishing knowledge and techniques at the community, provincial and national levels</li> </ol>	<p>Manpower</p> <p>Logistic &amp; support</p> <p>Materials/equipment</p>	SIG FFA Investors Res Owners NGOs	2008-2010 On-going	<p>Purchase, instalment of equipment and facilities</p> <p>Utilization of new fishing techniques</p> <p>Improved production</p>	Daily and weekly monitoring
Establish coastal buffer zones and mangrove forest	<ol style="list-style-type: none"> <li>1. Plant mangroves on coastal areas</li> <li>2. Select suitable plant species</li> <li>3. Provide training for beneficiaries</li> <li>4. Provide planting materials</li> </ol>	<p>Manpower</p> <p>Logistic &amp; support</p> <p>Materials/equipment</p>	SIG, FFA Investors Res Owners NGOs	2008-2010 On-going	Establishment of mangrove and coastal forest	Daily and weekly monitoring
Formulation of a Tuna Management Plan?			FFA			
<b>12. Tourism</b>						
Tourism entrepreneurs must have effective emergency plan	<ol style="list-style-type: none"> <li>1. Consultations</li> <li>2. Tourism Data base</li> <li>3. Trainings</li> <li>4. Establish an emergency plan</li> <li>5. Review of emergency plan</li> </ol>	Funding Human Resources Materials	MTC Tourism entrepreneurs Relevant NGOs NDMO SIRC	January 2009	Trained, and informed entrepreneurs Emergency plan developed Action Plan developed Training manuals	questionnaires, interviewing, observation
Tourism operators must be trained educated on first aid and risk safety proactive measures	<ol style="list-style-type: none"> <li>1. First Aid training</li> <li>2. Occupational Health &amp; Safety in Place (also noted under health sector)</li> <li>3. Safety drills</li> <li>4. Safety Manuals</li> </ol>	Materials Funding Personals	SIRC NDMO MHMS MCT	April 09	Operators and personal trained on First Aid	Evaluate training tool kit
Must have first aid kits and equipments (this objective can an activity under the above)	<ol style="list-style-type: none"> <li>1. Purchase of kits</li> </ol>	Funding equipments Prepare storage room	MCT NDMO	July 09	Tourism operators must have in store the 1 <sup>st</sup> aid kits Reduce course of death	Evaluate the state of the equipments Rephrase courses
Encourage traditional food preservation methods	<ol style="list-style-type: none"> <li>1. Organized group of resourceful personals</li> <li>2. Identify personal in communities</li> <li>3. Document traditional methods of food preservation (Relate to</li> </ol>	Funding Materials (paper, audio, visual)	MAL MCT NGO		Traditional food preservation are documented	Evaluate information gathered and see if there are information that need to be incorporated

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date	Expected Output	Evaluation
	Agriculture & Health Sector)					
<b>13. Infrastructure</b>						
Climate proofing of infrastructures (Similar to Health Sector with regards to clinics)	<ol style="list-style-type: none"> <li>1. Establish strict policy guidelines on building codes</li> <li>2. Acquire climate proof materials</li> <li>3. testing of material strenghts</li> <li>4. purchase of materials</li> <li>5. Develop policies that incorporates the impacts of climate change</li> <li>6. Incorporation of climate scenarios in the design and engineering stage</li> </ol>	Funding Storage room Technical Assistance	Government (MIW, HCC)	2009-2010	Infrastructures that can withstand the impacts climate change	Evaluate materials Trainings/ manuals Observations
Ensure that buildings are not built near river banks and high risk areas	<ol style="list-style-type: none"> <li>1. Restriction of identified vulnerable sites</li> <li>2. Documentation of vulnerable sites for engineers and planners</li> <li>3. Strict land use policy</li> <li>4. Awareness and educational programs</li> </ol>	Personals Funding	MECM, NDMO MID, NGOs Communities Physical Planners	2009-2010	<p>People will not build on risk areas</p> <p>People are inform to make right decisions</p>	<p>Evaluate possible risk areas</p> <p>Evaluate effective awareness methods</p>
<b>14. Environment</b>						
Encourage coastal tree planting	<ol style="list-style-type: none"> <li>1. Awareness</li> <li>2. Select Suitable plant species</li> <li>3. Provide planting materials</li> <li>4. Trees planting</li> </ol>	Funding Technical personals Plant materials Resource materials Propagation structures (similar to Agriculture sector activity)	MECM, MLA NGOs, MF Communities	Oct 09	<p>Communities aware of risk</p> <p>Tree planted along coastal areas</p> <p>Reduction of coastal erosion</p>	Evaluate effective awareness methods Assess the types of trees planted
Re-plantation of coastal and terrestrial plants and mangroves	<ol style="list-style-type: none"> <li>1. Collecting of plant materials</li> <li>2. Awareness and assessments</li> <li>3. Mangrove Planting</li> </ol>	Funding Plant materials Personals	MECM, MLA, NGOs, MF Communities	Dec 09	<p>Communities aware of reasons of replanting of coastal areas</p> <p>Areas are identified for plantings</p>	Assess methods of awareness Assess planting materials and plant planted
Discourage cutting of trees on the river banks	<ol style="list-style-type: none"> <li>1. Awareness programs</li> <li>2. Enforce Forest resource and Utilization Act. and bye-laws</li> </ol>	Personals funding	MECM, MLA, NGOs, MF Min. of Forest Communities	Jan 10	<p>Communities aware of importance of planting trees along coastal areas and river banks</p>	Assess method of awareness
<b>15. People</b>						
Provision of tanks for	<ol style="list-style-type: none"> <li>1. Consultation</li> <li>2. Identify</li> </ol>	Funding Human	NCW , Relevant	2009-2010	Tanks are provided to	Community Observation

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date	Expected Output	Evaluation
rainwater harvesting	3. communities/ Individuals 4. Provision of water harvesting structures	Resources ICT Materials	Women's organization/ NGO & Gov't RWSSS, SIWA, Communities		communities/ families Accessibility to clean drinking water	Interviews
Encourage use of traditional food preservation methods	1. Identification of communities with traditional preservation methods 2. Advocacy programs 3. Organized group of resourceful personnel's 4. Document traditional methods of food preservation	Funding Materials (paper, audio, visual)	SI NCW & other relevant Ministries, Communities & NGOs, KGA	2009-2010	Revive of traditional preservation methods Preservation methods acquired	Interviews Observations
Diversification of food crops	1. Introduction of new crops 2. Establishment of Post entry Quarantine facility to accommodate introduced crops 3. Identify local food crops for diversification (Similar to Health Sector activity) 4. Awareness 5. Provide Planting materials	Finance Agriculture Experts Plant Import permit from Quarantine	MAL/Research & Quarantine) Kastom Gaden Association Communities	2009-2010	New crops Variety of crops	Observations Reports Interviews
Encourage traditional adaptation methods	1. Identify Traditional adaptation methods 2. Encourage traditional adaptation methods to vulnerable communities 3. Encourage existing methods and mechanisms	Finance Local Experts Traditional Knowledge	Local communities Provincial governments, NDMO, NGO's, KGA	2009-2010	Early warning system indicators introduced (Similar to Health Sector Activity) Hard adaptation methods introduced and localized	Survey of relevant adaptation mode of its relevancy
Encourage pre-season preparedness	1. Establish early warning systems & networking (Similar to Health & Agriculture Sector ) 2. Public awareness 3. Community Consultation	Finance Local experts Communities	NDMO,, MECM NGO's, Provincial government	2009-2010	Communities are aware pre-season preparedness to equip them for any disaster	Review method of awareness Conduct consultation with communities and other partners of interest
<b>16 .Traditional Culture</b>						
Vulnerability Assessment	1. Consultation	Technical experts, Financial support, Logistics, equipment & tools,	MoL, Prov Govt, MPG,, NDMO, CCO, MECM, Relevant stakeholders.	3-6 months	Verifications of data of potential activities,	Field visits Dir. Observation Questionnaires

Risk Solution (Objective)	Adaptation Activities	Resources Required	Responsible Agency	Date/line	Expected Output	Evaluation
Planting of mangrove along coastlines	1. Plant mangrove seedlings, 2. Encourage community participation	Technical experts, finance, equipment	MECM, Communities, SIRC, Prov. Govt, MoL, MFMR	1-3 months	New mangrove patches,	Field visits Dir. Observation Questionnaires
Documentation of traditional cultural norms and practices	1. Researchers, local experts 2. documentary writers, 3. film producers, photographers	Technical experts, Finance, equipment, tools, logistic support,	MEHRD, MCT, MPJL, Communities, Prov Authorities, NCW	1-3 yrs	Documented materials, Audio Visual records	Field visits Dir. Observation Questionnaires Films Photographs
Implement emergency response measures	1. Water rationing, (also covered by water resources sector) 2. awareness on responsible use of water,	Financial Support, Technical experts, equipments, awareness materials,	MID, SIWA, RWSS, MECM, SIRC, NDMO, WRD, MHMS,	1-4 wks	To put inplace emergency response mechanisms	Assessments Teams Field visits Dir. Observations
Promote responsible use of water (or Awareness on water conservation)	1. Awareness	Financial Support, Technical experts, equipments, awareness materials,	MID, SIWA,, RWSS, MEM, MECM, NCW, Communities, WRD, MHMS, relevant stakeholders	On-going	How to use ater wisely	Dir. Observation Questionnaires Use of secondary data

## ANNEX 2- Communities and Villages Consulted

- 1. Guadalcanal Province**
  - a) Bemuta
  - b) Kogmabulu
  - c) Ngalimera
  - d) Laovavasa
  - e) Visale
  - f) Magasin
  - g) Oboabo
  - h) Vatumauri
- 2. Isabel Province**
  - a) Buala village
  - b) Isabel Provincial Officials
  - c) Magholau
- 3. Malaita Province**
  - a) Langalanga
  - b) Kwai Island
  - c) Ngongosila
  - d) East Areare - Hunanawa
- 4. Makira Province**
  - a) Nausuri , Santa Catalina
  - b) KiraKira
- 5. Central Province**
  - a) Kaugele (Savo)
  - b) Sunset Resort (Savo)
  - c) Bonala (Savo)
  - d) Bonvesta (Gela)
  - e) Siro Community High School (Gela)
  - f) Tubila Village (Gela)
  - g) Olevuga Village (Gela)
  - h) Maravagi (Gela)
- 6. Rennel Province**
  - a) East Rennell
  - b) West Rennell
  - c) Bellona
- 7. Western Province**
  - a) Noro Town
  - b) Rawaki
  - c) Canan
  - d) Tuguvili
  - e) Munda Station