

**SOPAC Member Countries  
National Capacity Assessments:  
Tsunami Warning and Mitigation Systems**

**Republic of Kiribati**



Republic of Kiribati



***SOPAC***





# SOPAC Member Countries National Capacity Assessments: Tsunami Warning and Mitigation Systems

**KIRIBATI, Tarawa**  
**8 – 10 September 2008**





## Document Control

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# Table of Contents

<b>1. RESULTS OUTLINE.....</b>	<b>1</b>
1.1. EXECUTIVE SUMMARY .....	1
1.2. RECOMMENDATIONS (INCLUDING PRIORITY AND RESOURCE INTENSITY) .....	3
<b>2. PROJECT BACKGROUND.....</b>	<b>9</b>
2.1. ABOUT THE PROJECT .....	9
2.2. BROAD PROJECT AIM .....	9
2.3. KEY PROJECT OUTPUT.....	9
2.4. PROJECT METHODOLOGY .....	9
2.5. UNDERLYING POLICY OBJECTIVES OF THE AUSTRALIAN TSUNAMI WARNING SYSTEM PROJECT ..	10
2.6. TSUNAMI WARNINGS IN THE PACIFIC .....	10
2.7. INTERNATIONAL TSUNAMI FORUMS.....	10
<b>3. COUNTRY BACKGROUND AND THE TSUNAMI THREAT.....</b>	<b>12</b>
3.1. ABOUT KIRIBATI .....	12
3.2. TSUNAMI THREAT SOURCES AND TSUNAMI HISTORY IN KIRIBATI.....	14
<b>4. THE KIRIBATI TSUNAMI CAPACITY ASSESSMENT.....</b>	<b>18</b>
4.1. DATE AND LOCATION .....	18
4.2. VISITING ASSESSMENT TEAM AND PARTICIPANTS.....	18
4.3. WORKSHOP SUMMARY .....	18
4.3.1. <i>Day 1 (8 September 2008)</i> .....	18
4.3.2. <i>Day 2 (9 September 2008)</i> .....	19
4.3.3. <i>Day 3 (10 September 2008)</i> .....	19
4.3.4. <i>Visits</i> .....	19
4.4. WORKSHOP PHOTOS (TARAWA SEPTEMBER 2008).....	20
<b>5. ASSESSMENT RESULTS.....</b>	<b>21</b>
5.1. STATUS OF KEY SYSTEM COMPONENTS.....	21
5.2. CASE STUDY – TSUNAMI SYSTEM OPERATION IN KIRIBATI FOR THE APRIL 2007 SOLOMON ISLANDS TSUNAMI EVENT .....	28
5.3. STRENGTHS, OPPORTUNITIES FOR IMPROVEMENT AND RECOMMENDATIONS TO PROGRESS THE TSUNAMI AGENDA IN KIRIBATI .....	29
5.3.1. <i>Governance and Coordination</i> .....	29
5.3.2. <i>Regional and International Coordination</i> .....	30
5.3.3. <i>Research Expertise</i> .....	31
5.3.4. <i>Tsunami Monitoring Infrastructure</i> .....	32
5.3.5. <i>Tsunami Warnings</i> .....	33
5.3.6. <i>Communications</i> .....	34
5.3.7. <i>Tsunami Emergency Response (including evacuation)</i> .....	36
5.3.8. <i>Tsunami Hazard, Vulnerability, Risk and Mitigation</i> .....	37
5.3.9. <i>Public and Stakeholder Awareness, Education and Training</i> .....	38
5.4. ADDITIONAL WORKSHOP BENEFITS .....	40
5.5. NEXT STEPS .....	40
<b>6. ANNEXURE.....</b>	<b>41</b>
6.1. ANNEXURE 1: RECORD OF PARTICIPANTS .....	41
6.2. ANNEXURE 2: THE VISITING ASSESSMENT TEAM .....	45
6.3. ANNEXURE 3: AGENDA, KIRIBATI TSUNAMI CAPACITY ASSESSMENT WORKSHOP .....	46
6.4. ANNEXURE 4: SUPPORTING DOCUMENTS LOG.....	52
6.5. ANNEXURE 5: DEFINITIONS .....	54
6.6. ANNEXURE 6: REFERENCES.....	59
<b>7. CD ATTACHMENT - SUPPORTING DOCUMENTS.....</b>	<b>60</b>



## Acronyms

AFTN	Aeronautical Fixed Telecommunications Network
AGD	Australian Attorney-General's Department
AM	Amplitude Modulated
ARFF	Aircraft Rescue and Fire Fighting
ATWS	Australian Tsunami Warning System
AusAID	Australian Agency for International Development
Bureau	Australian Bureau of Meteorology Bureau
D	Document (e.g. Document 39 = D39)
DFAT	Australian Department of Foreign Affairs and Trade
DRM	Disaster Risk Management
EMA	Emergency Management Australia
EMWIN	Emergency Managers Weather Information Network
FM	Frequency Modulated
GA	Geoscience Australia
GIS	Geographic Information System
GTS	Global Telecommunications System
HF	High Frequency
ICG	Intergovernmental Coordination Group
IOC	Intergovernmental Oceanographic Commission
IPCC	Intergovernmental Panel on Climate Change
ISDR	International Strategy for Disaster Reduction
ITSU	ICG for the Tsunami Warning System in the Pacific
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
KANGO	Kiribati Association of NGOs
KAP	Kiribati Adaptation Project
KMS	Kiribati Meteorological Service
Mw	Moment Magnitude
NDMO	National Disaster Management Office
NEOC	National Emergency Operations Centre
NGDC	National Geographic Data Centre
NGOs	Non-Government Organisations
NIWA	National Institute of Water and Atmospheric Research
NOAA	National Oceanic and Atmospheric Administration
NZ	New Zealand
OB	Office of the President (te Beretitenti)
PGSP	Pacific Governance Support Programme
PICs	Pacific Island Countries
PTWC	Pacific Tsunami Warning Centre
PTWS	Pacific Tsunami Warning and Mitigation System
RANET	Radio and Internet for the Communication of Hydro-Meteorological Information for Rural Development
RSMC	Regional Specialised Meteorological Centre
SOPAC	Pacific Islands Applied Geoscience Commission



## Acronyms (Continued)

SOPs	Standard Operating Procedures
TAK	Telecommunications Authority of Kiribati
TSKL	Telecom Services Kiribati Limited
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
USAID	United States Agency for International Development
USGS	United States Geological Survey
UTC	Coordinated Universal Time
WMO	World Meteorological Organisation





# 1. Results Outline



# 1. Results Outline

## 1.1. Executive Summary

The National Capacity Assessment of Pacific Islands Applied Geoscience Commission (SOPAC) Member Countries: Tsunami Warning and Mitigation Systems project aims to work in collaboration with the member countries of SOPAC to assess their capacity to receive, communicate and respond effectively to tsunami warnings. The Tsunami Capacity Assessment of the ability of the Republic of Kiribati (hereafter referred to as “Kiribati”) to receive, communicate and effectively respond to tsunami warnings took place in a workshop held from 8 – 10 September 2008 in Tarawa, Kiribati.

The workshop was facilitated by a team of visiting experts and attended by some forty Kiribati Government agency representatives, Non-Government Organisations (NGOs), regional and international organisations and the private sector to discuss key areas of tsunami warning and mitigation in Kiribati by completing a comprehensive questionnaire in session, presentations and site visits.

As well as outlining Kiribati’s current status, strengths and opportunities for improvement with regard to tsunami warning and mitigation, a list of recommendations were formulated by the Visiting Assessment Team in consultation with national participants. The aim of these recommendations is to guide further capacity development programs to target ongoing improvements in Kiribati’s tsunami warning and mitigation system.

The distributed nature of the Kiribati Islands and the features of the sea-bed within the archipelago means that exposure to tsunami and possible tsunami impacts are likely to be variable from island to island. Tsunami risk modelling and very few historical records of tsunami events would suggest Kiribati has a lower tsunami risk relative to other Pacific Islands Countries (PICs) closer to subduction trenches on which earthquakes with the potential to generate tsunami can occur. Although the Kiribati population and government have had no direct experience with tsunami impacts, there is an awareness of the susceptibility of low-lying atolls to rising sea levels associated with climate change and the potential for tsunami impact. Kiribati’s National Disaster Act 1993 (D1) lists tsunami as a potential disaster that may impact upon Kiribati.

Various studies highlight the main tsunami threat source for Kiribati as the Kurils Trench. There have, since 1994, been two small events detected at the Tarawa sea level gauge from this trench. These events were both Moment Magnitude ( $M_w$ ) = 8.3 events on 4 October 1994 and the 15 November 2006. Both events resulted in small (less than 10cm height) tsunami waves at Tarawa. For the November 2006 event, Kiribati was placed under a “tsunami watch” by the Pacific Tsunami Warning Centre (PTWC). The only other tsunami recorded on the Tarawa sea level gauge in recent times is from West Papua (Indonesia) in February 1996. A magnitude  $M_w$  = 8.2 local event resulted in a small tsunami of less than 10cm height in Tarawa.

Most recently, Kiribati has been placed under a “tsunami warning” by the PTWC for the 2 April 2007 Solomon Islands earthquake and tsunami generated by a magnitude  $M_w$  = 8.1 earthquake on the South Solomons Trench. No visible sign of this tsunami was recorded on the Tarawa sea level gauge. Kiribati’s national response to the Solomon Islands tsunami was reviewed during the workshop to enable the Visiting Assessment Team to gain an understanding of how Kiribati’s system operates in a real event.

Kiribati’s National Disaster Act 1993 (D1) establishes command and control arrangements for managing a range of disasters from tsunami, other natural and man made disasters. At the time of the workshop, much of the content of this legislation was yet to be implemented. Kiribati did not have a National Disaster Management Plan or tsunami sub-plan. Tsunami warnings were received by the Kiribati Meteorological Service (KMS) however, the key communications system

for receiving tsunami warnings from the PTWC was not operational. Currently, after receiving the PTWC messages, KMS passes these onto the Office of the President (Te Beretitenti) (OB). This office is not staffed 24/7. No system currently exists for dissemination of tsunami warnings to the Kiribati community nationally.

Participants in the workshop identified a number of areas for improvement. Recurring themes included improved emergency response planning, enhancement of community tsunami awareness, enhancement of communications systems and interagency cooperation. The workshop's recommendations reflected this and the very high priority included the following:

Formalisation of Disaster Risk Management (DRM) structures and strategies at the national and local levels including the National Disaster Council, Local Government Disaster Committees, National Disaster Management Plan and Council, Village, NGO and private sector Disaster Risk Management Plans;

That full authority and responsibility for analysing and interpreting tsunami messages and data and issuing tsunami warnings for Kiribati be formally delegated to KMS under a set of developed and agreed Standard Operating Procedures (SOPs);

Effective resourcing of KMS and the National Disaster Management Office (NDMO) to effectively carry out their legislated tasks;

Expansion of the current tsunami education initiatives to include a multi-government and NGO approach and incorporate tsunami education into a multi-hazard education framework (including enhancement of school curricula);

Use the tsunami hazard studies completed for the Southwest Pacific Nations to date, historical records, Geographic Information System (GIS) data and deep ocean models to identify low-lying communities potentially at tsunami risk. Commence tsunami mitigation planning using this and local knowledge;

Investigate available practical and sustainable technology solutions, such as the RANET (Radio and Internet for the Communication of Hydro-Meteorological Information for Rural Development) Chatty Beetle to aid in dissemination of warning messages to remote communities, particularly outside of waking hours;

Establish a Central Operations Group to oversee the effective allocation of operational tasks and resources during an operational event as well as an appropriately located and resourced National Emergency Operations Centre (NEOC); and

That a tsunami capacity development / training program be developed, including training and exercising for emergency managers, NGOs and KMS staff and that this be done in a competency-based framework.

Participants at the workshop expressed that there is an intention to establish a National Tsunami Warning Centre operating under the OB. KMS would then forward tsunami messages to this office for action. This National Tsunami Capacity Assessment report suggests that Kiribati need to consider whether this is the most efficient use of resources. This approach would involve replication of resources on a level equal to KMS, including communications systems and a 24/7 roster. The National Tsunami Capacity Assessment report suggests a more viable option may be to give KMS full authority to issue tsunami warnings nationally for Kiribati, based on a warning matrix and format pre-agreed with OB.

Kiribati workshop participants are encouraged to use this National Tsunami Capacity Assessment report to guide both national projects and aid funded projects to achieve targeted improvements in Kiribati's tsunami warning and mitigation system. In turn, this will assist in improving systems for other high priority natural hazards.

Contingent on the availability of human and financial resources, the Bureau and project partners will aim to work with potential donors to bring the findings of this project to their attention on a country and regional scale. This will be done in the hope of further capacity development projects being undertaken.

## 1.2. Recommendations (including priority and resource intensity)

Table 2 outlines the priority and resource intensity for the recommendations made to improve Kiribati's tsunami warning and mitigation system. Both the priority and resource intensity are based on the consensus of the visiting Tsunami Capacity Assessment team after discussions held within the Tsunami Capacity Assessment Workshop. It is recognised that these rankings may not reflect the opinions of all individuals involved in the workshop as priorities vary depending on personal responsibilities and areas of interest. Each recommendation is important in its own right to achieve holistic improvements in Kiribati's tsunami warning and mitigation system.

The priority ranking and resource intensity scale used as a basis for allocating a priority and resource intensity to each recommendation is explained in Table 1. The Very High priority recommendations should be seriously considered as requiring urgent completion. Low resource intensity recommendations are considered the 'low-hanging fruit' that are achievable with very few additional resources.

**Table 1: Priority ranking and resource intensity scale**

PRIORITY	RESOURCE INTENSITY
<b>Very High</b>	<b>Low</b> – Recommendation currently being progressed or could possibly be progressed within the capacity of existing in-country resources (funds and staff).
<b>High</b>	<b>Medium</b> – Recommendation could be progressed by existing staff or with a low to moderate number of additional staff and/or expertise and a moderate level of additional in-country funds. May or may not require external funding.
<b>Medium</b>	<b>High</b> – Recommendation would require a high level of additional staff and/or expertise and funds. External funding support is likely to be required.
<b>Low</b>	<b>Very High</b> – Recommendation would require a very high level of additional staff and funds. External funding support will be required.



**Table 2: Priority and anticipated resource intensity for completion of recommendations made for improving Kiribati's tsunami warning and mitigation system.**

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	Formalise establishment of the National Disaster Council in accordance with the provisions of the National Disaster Act 1993 (D1).	Low	Governance & Coordination	Multi-hazard	1
Very High	That full authority and responsibility for analysing and interpreting tsunami messages and data and issuing tsunami warnings for Kiribati be formally delegated to KMS.	Low	Tsunami Warning	Tsunami specific	10
Very High	Expansion of earthquake and tsunami school curriculum to include tsunami preparedness (warning process and action to take).	Low	Public and Stakeholder Awareness, Education & Training	Tsunami specific	27
Very High	Commence discussions with Local Government Councils throughout Kiribati to establish Disaster Committees to ensure comprehensive and community integrated DRM including the development of Council and Village DRM Plans (supporting a National DRM Plan).	Medium	Governance & Coordination	Multi-hazard	3
Very High	Require government agencies, NGOs and key private sector organisations to develop their own Disaster Risk Management Plans for their areas of responsibility. If required, enhance legislation to make this a requirement.	Medium	Governance & Coordination	Multi-hazard	4

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	KMS, in consultation with OB and other key stakeholders, develop SOPs for the operation of Kiribati's tsunami warning service. This should include a pre-agreed warning decision making matrix outlining what action will be taken by key agencies for each PTWC message and what public advice will be issued.	Medium	Tsunami Warning	Tsunami specific	11
Very high	Use the tsunami hazard studies completed for the Southwest Pacific Nations to date, historical records, GIS data and deep ocean models to identify low-lying communities potentially at tsunami risk. Commence tsunami mitigation planning using this and local (and traditional) knowledge.	Medium	Tsunami Hazard, Vulnerability, Risk & Mitigation	Tsunami specific	24
Very high	Ensure KMS staffing levels are maintained at levels sufficient to effectively run 24/7 operations as well as being adequately resourced to operate all communications systems available to KMS to ensure redundant capability.	High	Tsunami Warning	Multi-hazard	12
Very High	Complete and implement a strategic National DRM Plan including prevention (mitigation), preparedness (planning and training), response (plan activation) and recovery (immediate and long term). Commence development of sub-plans relevant to each hazard with the potential to affect Kiribati (including tsunami).	High	Governance & Coordination	Multi-hazard	2
Very high	Investigate available practical and sustainable technology solutions, such as the RANET Chatty Beetle to aid in dissemination of warning messages to remote communities, particularly outside of waking hours.	High	Communications	Multi-hazard	19

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	Resource the NDMO to effectively carry out DRM (including Disaster Risk Reduction and Disaster Management Coordination roles).	High	Tsunami Emergency Response (including evacuation)	Multi-hazard	21
Very High	That a tsunami capacity development / training program be developed, including training and exercising for emergency managers, NGOs and KMS staff and that this be done in a competency-based framework.	High	Public & Stakeholder Awareness, Education & Training	Tsunami specific and multi-hazard (depending on training conducted)	29
Very high	Establish a Central Operations Group to oversee the effective allocation of operational tasks and resources during an operational event as well as an appropriately located and resourced NEOC.	Low (establish group), High (resource NEOC)	Tsunami Emergency Response (including evacuation)	Multi-hazard	20
Very High	Expansion of the current tsunami education initiatives to include a multi-government and NGO approach and incorporate tsunami education into a multi-hazard education framework. Include expansion of tsunami awareness kit distribution, incorporation of education into the monthly meetings of Island Councils and consideration of media multi-hazard education.	Medium to High (depending on action taken)	Public and Stakeholder Awareness, Education & Training	Tsunami specific	28
High	Investigate the feasibility of activating radio stations to disseminate information outside normal hours of operation.	Medium	Communications	Multi-hazard	14
High	Coordinate government agencies, churches, NGO radio networks to assist in spreading information to public.	Medium	Communications	Multi-hazard	15
High	Coordinate use of police and ambulance sirens, church bells to alert public.	Medium	Communications	Multi-hazard	16

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	Incorporate into the tsunami sub-plans a regime for the regular multi-stakeholder test of the tsunami warning and response arrangements including a post event debrief.	Medium	Tsunami Emergency Response (including evacuation)	Tsunami specific	22
High	Nominate, resource and ensure procedures are in place for a second 24/7 agency to receive PTWC messages as a backup to KMS.	High	Tsunami Warning	Tsunami specific	13
High	In consideration of Kiribati's low lying nature, consider and make plans for the safe evacuation of at risk communities. Options may include moving inland and vertical evacuation. Include consideration of evacuation shelters, maps, signage and drills.	High	Tsunami Emergency Response (including evacuation)	Tsunami specific	23
High	Capitalise on climate change studies to acquire the necessary high resolution topography and bathymetry data for centres at risk of tsunami as part of a multi-hazard mapping activity. This data can then feed into hazard assessments, modelling and mapping for hazards including climate change, tsunami and storm surge.	Very High	Tsunami Hazard, Vulnerability, Risk & Mitigation	Multi-hazard	25
Medium	Build on existing climate change adaptation relationships with international and regional bodies to incorporate DRM initiatives where appropriate.	Low	Regional & International Coordination	Multi-hazard	6
Medium	Become a member of the Intergovernmental Oceanographic Commission (IOC) to ensure Kiribati has a voice in determining IOC programmes and activities of benefit nationally as well as benefiting from IOC capacity building in marine science.	Low	Regional & International Coordination	Multi-hazard	7

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Medium	Participate in the Pacific Tsunami Warning and Mitigation System (PTWS) Southwest Pacific Working Group by nominating a representative of Kiribati to be on this working group. Use this group to learn about regional initiatives and initiatives of other PICs with regard to tsunami warning and mitigation systems in remote and low lying islands.	Medium	Regional & International Coordination	Tsunami specific	5
Medium	Proactively encourage and actively cooperate with regional and international organisations that can assist with conducting scientific research and building technical capacity building in Kiribati. Ensure this research and capacity building is conducted in line with Kiribati's national sustainable development priorities and that a protocol is developed to ensure copies of scientific research reports and data are provided to Kiribati.	Medium	Research Expertise	Multi-hazard	8
Medium	Investigate access to and training in the interpretation of Pacific sea level data at KMS via the Global Telecommunications System (GTS) or the Bureau Registered User Website to assist in tsunami verification and early warning.	Medium	Tsunami Monitoring Infrastructure	Tsunami specific	9
Medium	Review television licensing arrangements to allow warnings.	Medium	Communications	Multi-hazard	17
Medium	Review satellite and radio telecommunication licensing fees to facilitate development of better communications systems.	Medium	Communications	Multi-hazard	18
Medium	Investigate future, long term options for completing tsunami inundation modelling in partnership with regional and international bodies, particularly for population and infrastructure centres.	Very High	Tsunami Hazard, Vulnerability, Risk & Mitigation	Tsunami specific	26



## 2. Project Background





## 2. Project Background

### 2.1. About the Project

The National Capacity Assessment of SOPAC Member Countries: Tsunami Warning and Mitigation Systems project aims to work in collaboration with the member countries of SOPAC to assess their capacity to receive, communicate and respond effectively to tsunami warnings. The Bureau is the lead implementing agency, in partnership with the Australian Attorney-General's Department (AGD), (formerly Emergency Management Australia (EMA)), SOPAC, and with the assistance of the IOC a division of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The project is funded by the Australian Agency for International Development (AusAID) under the Pacific Governance Support Programme (PGSP). It is implemented under an agreement (Schedule 5 to the Record of Understanding 14304, June 2006) between AusAID and the Bureau). The fourteen SOPAC member countries participating in the project are the Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, the Solomon Islands, Tonga, Tuvalu and Vanuatu.

### 2.2. Broad Project Aim

By undertaking an assessment of the capacity of individual nations to manage tsunami events, the project aims to better guide donor funding towards achieving targeted improvements in the tsunami warning and mitigation systems in the respective countries.

### 2.3. Key Project Output

The key deliverable of the project is a comprehensive set of reports, including one national report specific to each country, detailing the strengths and opportunities for improvement of the country with regard to tsunami warning and mitigation. The national report for each country also includes recommendations to address priority issues. These reports will then feed into a consolidated Regional report that will aim to identify common issues across the Region with regard to tsunami warnings and mitigation.

### 2.4. Project Methodology

National assessments in each SOPAC member country are conducted by visiting teams including experts in the fields of tsunami warnings, emergency management, disaster risk reduction and data and warning communications. The visiting team meets with in-country experts during a four-day workshop involving government agencies, the private sector, NGOs and regional and international organisations involved in tsunami and natural disaster management.

The workshop aims to complete a questionnaire covering all aspects of tsunami warning and mitigation and gather information to support questionnaire responses. This information then feeds into the national report. Consultation with individual countries before completion of the report is an integral part of the report writing process.

The questionnaire for the PICs is a modified version of that used for the Indian Ocean equivalent project. The Indian Ocean questionnaire was jointly developed by UNESCO/IOC, SOPAC, the World Meteorological Organisation (WMO) and the International Strategy for Disaster Reduction (ISDR). Details of the Indian Ocean equivalent project can be found at:

<http://www.ioc-tsunami.org/content/view/275/978/>

## 2.5. Underlying Policy Objectives of the Australian Tsunami Warning System Project

The Bureau in partnership with Geoscience Australia (GA) and AGD, has recently completed a four-year project to establish the Australian Tsunami Warning System (ATWS). One of the three policy objectives of the ATWS project was “To contribute to the facilitation of tsunami warnings for the South West Pacific” (DFAT, 2006). The Tsunami Capacity Assessment project and this report, contributes to the achievement of this policy objective. Also, as part of the implementation of the ATWS, Australia has and will continue to contribute to the facilitation of more effective tsunami advisory bulletins to Pacific Island nations through the provision of seismic and sea level observations to the PTWC in Hawaii.

## 2.6. Tsunami warnings in the Pacific

Tsunami messages for the Pacific Ocean are issued by the PTWC in Hawaii as the United States of America (USA) contribution to the PTWS. Individual countries are then responsible for using this advice to distribute national tsunami warnings to their communities. PTWC messages can be Tsunami Warnings, Tsunami Watches, Tsunami Advisories and Tsunami Information Bulletin/Statement. For the purpose of this report, products from the PTWC will be referred to generically as ‘tsunami messages’. A full definition of each PTWC product can be found at [http://www.prh.noaa.gov/ptwc/about\\_messages.php](http://www.prh.noaa.gov/ptwc/about_messages.php)

## 2.7. International Tsunami Forums

Under the auspices of the IOC, the Intergovernmental Coordination Group (ICG)/PTWS (formerly known as ICG for the Tsunami Warning System in the Pacific (ITSU)) was first convened in 1968 (IOC, 2009). This is an international cooperative effort involving many IOC Member States of the Pacific Region. The ICG/PTWS meets regularly to review progress and coordinate activities resulting in improvements of the service (IOC, 2009).

The Working Group on Tsunami Warning and Mitigation in the Southwest Pacific Ocean was formed at the ICG/PTWS-XXI meeting in Melbourne in early May 2006 with the aim of enhancing tsunami warning and mitigation in the Southwest Pacific Ocean. The membership of the working group is composed of representatives from IOC Member States and other countries in the region (as members and observers). SOPAC provides secretariat support. The Working Group is currently chaired by a representative of New Zealand (NZ), with vice-chairs from Fiji and Samoa.

The Working Group has a number of Terms of Reference and this project is directly relevant to the following Terms of Reference:

- To evaluate capabilities of countries in the Southwest Pacific Region for providing end-to-end tsunami warning and mitigation services;
- To ascertain requirements from countries in the Southwest Pacific Region for the tsunami warning and mitigation services;
- To facilitate capacity building and the sharing of tsunami information in the region;
- To support the further development of the virtual centre of expertise in a multi-hazards context within SOPAC in line with the Regional Early Warning Strategy; and
- To facilitate the inclusion of tsunami hazard and response information into curricula, and development and dissemination of education materials.





### 3. Country Background and the Tsunami Threat



## 3. Country Background and the Tsunami Threat

### 3.1. About Kiribati

The Republic of Kiribati achieved independence in July 1979 and forms part of the Commonwealth (DFAT, 2009). The islands of Kiribati span a significant distance of the Pacific ocean with three archipelagos (the Gilbert Islands, Phoenix Islands and the Line Islands) of 33 low-lying atoll islands spread over a vast area of 3.5 million square kilometres of exclusive economic zone (World Bank, 2006). The land surface area of the 33 atolls is 811 square kilometres (DFAT, 2009).

The original inhabitants of Kiribati are Gilbertese, a Micronesian people (US Department of State, 2009). In 2008, the population of Kiribati was 100,000 (DFAT, 2009) with approximately 90% of the population living on the atolls of the Gilbert Islands. Owing to severe overcrowding in the capital on South Tarawa, in the 1990s a program of directed migration moved nearly 5,000 inhabitants to outlying atolls, mainly in the Line Islands (US Department of State, 2009). The Phoenix Islands have never had any significant permanent population. Kiribati includes Kiritimati (Christmas Island), the largest coral atoll in the world, and Banaba (Ocean Island), one of the three great phosphate islands in the Pacific (US Department of State, 2009).

In Kiribati the President (Te Beretitenti) is both Head of Government and Head of State. The President is elected by universal adult suffrage, following a nomination process in the Parliament. The President appoints his/her own Cabinet, comprising the President, Vice President, Attorney-General and no more than ten ministers selected from Members of the Maneaba ni Maungatabu (the 46 member unicameral parliament in which 44 members of parliament are elected for a four year term by non-compulsory universal adult suffrage). (DFAT, 2009).

Kiribati has largely had a solid record of financial stability since independence in 1979 due to conservative domestic Government spending and a policy of accumulating offshore investments. Kiribati has a limited range of economic assets and is reliant on distant water fishing licence fees, revenues from a phosphate-derived trust fund and overseas remittances from Kiribati citizens employed abroad (DFAT, 2009). Economic challenges include its small size, remoteness and geographical fragmentation, a harsh natural environment with infertile soils, limited exploitable resources and the need to create jobs for an expanding population (DFAT, 2009). Kiribati's key merchandise trade relationships (for both imports and exports as at 2005) were with Australia and Fiji (DFAT, 2009).

Most of the land on Kiribati is less than three metres above sea level and on average only a few hundred metres wide (World Bank, 2006). The vulnerability of the population to weather and climate related events such as storm surge and drought is exacerbated by high population concentration, accelerated coastal development and environmental degradation (World Bank, 2006).

The Government of Kiribati's 2008-11 National Sustainable Development Strategy focuses on six key areas for development: economic growth and poverty reduction, education, health, environment, governance and infrastructure (DFAT, 2009).



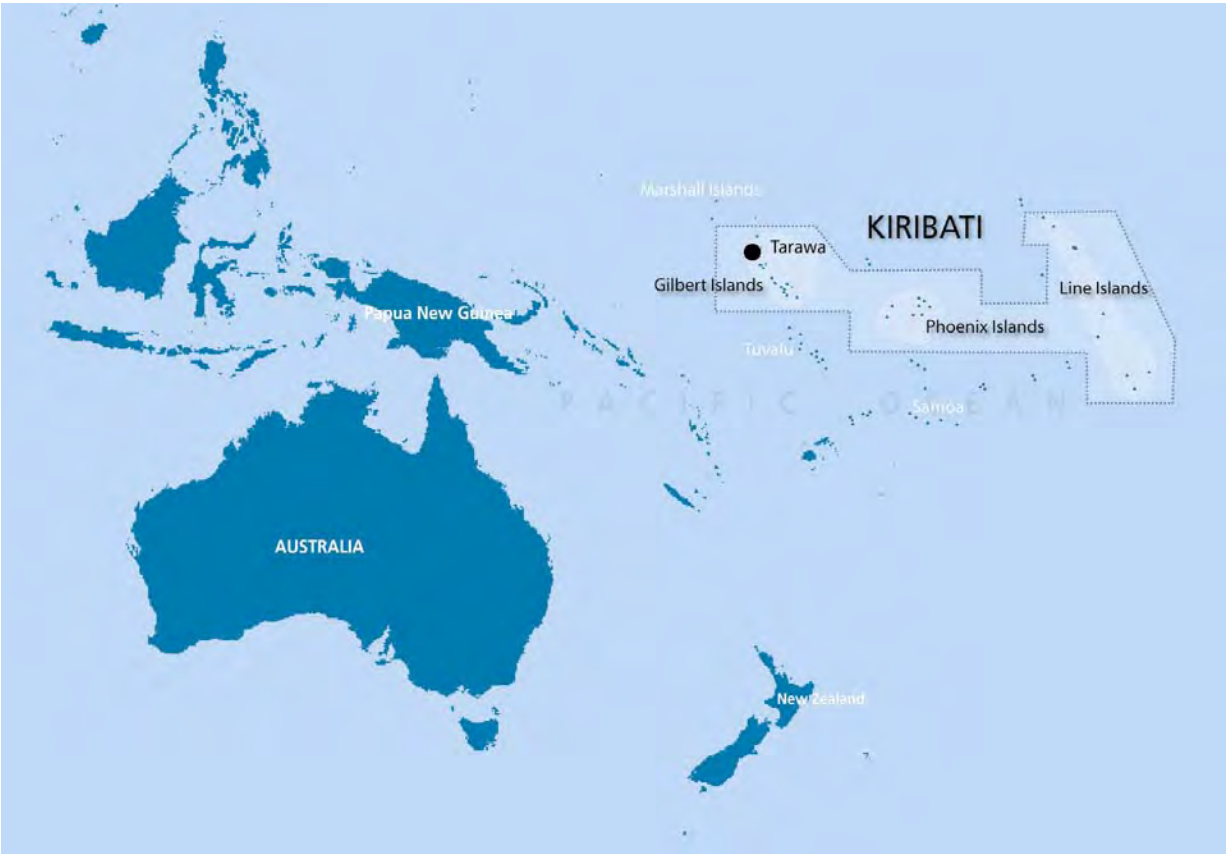


Figure 1: The Republic of Kiribati

## 3.2. Tsunami Threat Sources and Tsunami History in Kiribati

An overview of potential tsunami threat sources and tsunami history in Kiribati is outlined below. This information should be treated as general background only and does not attempt to complete a comprehensive picture of tsunami hazard and vulnerability for Kiribati. Such a study is outside the scope of this project. The distributed nature of the islands and the features of the sea-bed within the archipelago mean that exposure to tsunami and possible tsunami impacts are likely to be variable from island to island or island groups.

Tsunami risk modelling and the limited historical records of tsunami events would suggest Kiribati has a lower tsunami risk relative to other PICs closer to subduction trenches on which earthquakes with the potential to generate tsunami can occur. Although the Kiribati population and Government have had no direct experience with tsunami impacts, there is an awareness of the susceptibility of low-lying atolls to rising sea levels associated with climate change and the potential for tsunami impact. Kiribati's National Disaster Act 1993 (D1) lists tsunami as a potential disaster that may impact upon Kiribati.

Historical stories collected throughout the workshop of unusual historical sea behaviour may provide anecdotal evidence of tsunami. Participants expressed that felt earthquakes caused a cracked reef and large rocks deposited on two islands by a series of three 'magic waves'. This may point to Kiribati's southern islands (Tamana and Makin) and eastern islands (Kiritimati) facing tsunami risk.

Thomas, Burbidge and Cummins (2007) completed *A Preliminary Study into the Tsunami Hazard faced by Southwest Pacific Nations*. Scenarios for an 8.5 Moment Magnitude (Mw) and 9.0 Mw earthquakes were used to investigate normalised offshore (to a notional depth of 50 metres) wave amplitudes for tsunami caused by earthquakes along subduction zones (Refer Figure 2). In this study, Kiribati's maximum amplitude for all tide gauges for all Mw 9 tsunami was 99cm with the most significant source region being Peru (amplitude greater than 75cm at 50m depth or single most significant source region if no amplitude exceeds 75cm). For a Mw 8.5 tsunami the maximum amplitude reduced to 49cm but Peru still remained the most significant source region.

A further study completed by Thomas and Burbidge (2009) attempts to answer the question "which Pacific nations might experience offshore amplitudes large enough to potentially result in hazardous inundation, what are the probabilities of experiencing these amplitudes and from which subduction zones might these tsunami originate". The report breaks Kiribati down into the three island sub-groups due to the distributed nature of the islands. The findings of Thomas and Burbidge (2009) for the three island sub-groups are outlined below.

### **The Gilbert Islands**

The report states that "most of the hazard [for the Gilbert Islands] originates in the Kurils and New Hebrides trenches, with smaller contributions from the Mariana, Aleutians, Peru, Chile and Tonga trenches". Maximum amplitudes at a 2000 year return period in the order of 1.0 to 1.4 metres, with generally lower amplitudes in the most southerly islands. At a return period of 100 years maximum amplitudes in the order of 0.3 to 0.4 metres were typical.

### **The Phoenix Islands**

The origin of the hazard at a 2000 year return period for this region is predominantly the Kurils trench with similar contributions from the New Hebrides Trench and the Chile trench. Despite its proximity, the Tonga trench contributes little to the hazard because its orientation serves to direct tsunami energy south of the Phoenix Islands. Maximum amplitudes at all return periods from 10 to 2000 years are quite uniform with a maximum amplitude of the order of one metre for a 2000 year return period, and 0.2 to 0.3 metres for a 100 year return period.

### ***The Line Islands***

The major source of hazard for a 2000 year return period for the Line Islands is the Kurils trench, with smaller contributions from the Chile and Peru trenches. The maximum amplitudes are relatively uniform over all model output points in the Line Islands at all return periods between 10 to 2000 years, with a value of around 1.3 to 2.2 metres for a return period of 2000 years, and 0.3 to 0.5 metres for a return period of 100 years.

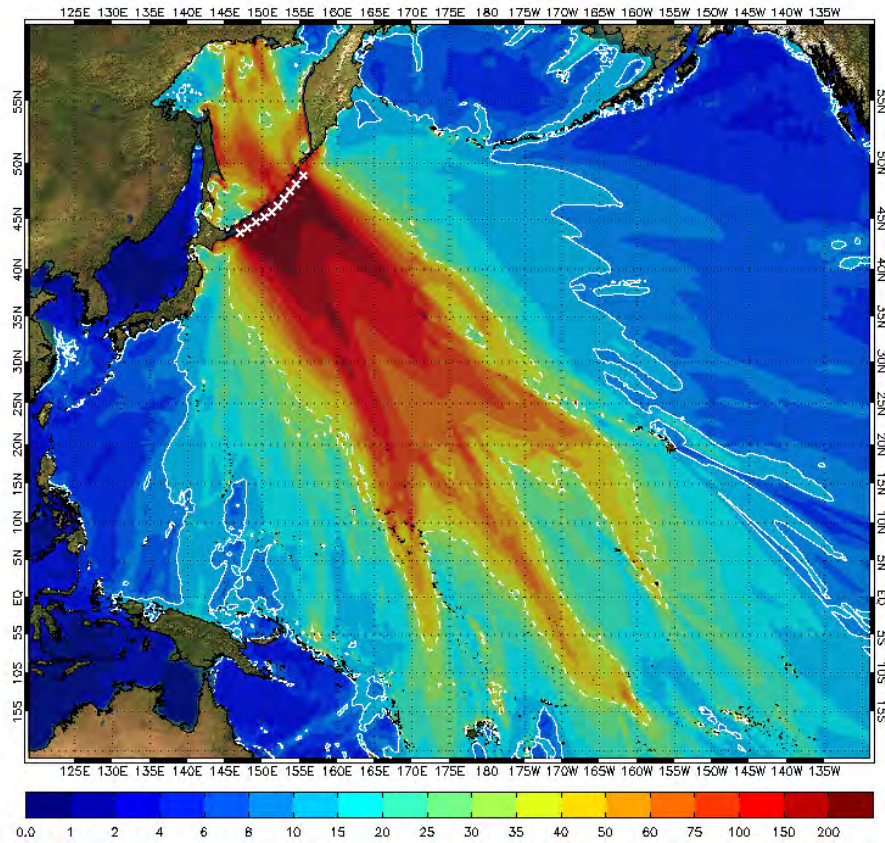
Investigation of the Bureau's deep ocean model-based tsunami prediction system conducted by Dr. Jane Warne in 2008 (ATWS Project Network Design Manager) demonstrated tsunami threat exists to varying degrees for Kiribati from local sources including the South Solomon, New Hebrides and Tonga Trenches with variable travel times of three to six hours. There is also limited threat from the Philippines and Mariana trenches with travel times of approximately four to seven hours. Long distance sources including Peru-Chile and Kuril trenches also have the potential to impact upon Kiribati with travel times between 15 to 30 hours.

The southern end of the South Solomon trench poses a threat to the eastern end of the Gilbert Islands. Only events of very large magnitude pose a significant threat. The islands have not experienced a measurable tsunami from this source in the past 20 years. The central section of the New Hebrides trench and the northern half of the Tonga trench pose some limited threat to Kiribati. Although the tsunami energy is not anticipated to be directed specifically at the island groups, side lobe energy may result in detectable events. The last event that originated on the New Hebrides trench that was detected in Tarawa was in 1994. The Tarawa sea level gauge has shown no records of tsunami impacting from the Tonga trench.

Tsunami energy from events on the Mindinau trench is focused in the general direction of Kiribati. However, only very large events would be anticipated to have minimal impact. The central section of the Mariana trench directs tsunami energy towards Kiribati and is thought to have the potential to cause significant impact for large events (greater than 8.5 Mw). The Tarawa sea level gauge has shown no records of tsunami impacting from either of these sources.

There have, since 1994, been two small events detected at the Tarawa sea level gauge from the Kuril trench. These events were both 8.3 Mw events on 4 October 1994 and the 15 November 2006. Both events resulted in small (less than 10cm height) tsunami waves at Tarawa. For the November 2006 event, Kiribati was placed under a "tsunami watch" by PTWC. The Kuril Islands must therefore be considered by Kiribati as a possible source of more serious impacts. The only other tsunami recorded on the Tarawa sea level gauge in recent times is from Irian Jaya (Indonesia) in February 1996. An 8.2 Mw local event resulted in a small tsunami of less than 10cm height in Tarawa.

Kiribati's PTWC travel time forecast points are Tarawa Island, Kanton Island, Christmas Island, Malden Island and Flint Island. Most recently, Kiribati has been placed under a "tsunami warning" by the PTWC for the 2 April 2007 Solomon Islands earthquake and tsunami generated by a magnitude 8.1 Mw earthquake. No visible sign of this tsunami was recorded on the Tarawa sea level gauge.



**Figure 2:** Maximum amplitude tsunami from magnitude 9.0 Mw earthquake scenario on the Kuril Trench. Tarawa, Kiribati is located at 1025N 1730E. (Source: Scenario 31d of experimental model T2, CAWCR, Australian Bureau of Meteorology).





Figure 3a: The subduction zones (in orange) of the Pacific Ocean



Figure 3b: The location of Kiribati (as denoted by its capital Tarawa) and other Pacific Island Countries in relation to regional and local subduction zones (in orange)



Section

4

## 4. The Kiribati Tsunami Capacity Assessment





## 4. The Kiribati Tsunami Capacity Assessment

### 4.1. Date and Location

The tsunami capacity assessment of the ability of Kiribati to receive, communicate and effectively respond to tsunami warnings took place from 8 to 10 September 2008, at the Otintaii Hotel in Tarawa, Kiribati. The visiting assessment team was made aware of two tsunami assessment workshops in 2000, conducted by SOPAC and in 2002 conducted by United States Agency for International Development (USAID), however, the nature and location of the recommendations and final reports from these workshops was not known by participants.

### 4.2. Visiting Assessment Team and Participants

The Visiting Assessment Team was made up of those outlined in Annexure 2. The in-country focal point for the project in Kiribati was Mr. Moreti Tibiriano, KMS Chief Meteorological Officer. A full list of workshop participants can be found in Annexure 1.

### 4.3. Workshop Summary

For a copy of the full agenda for the workshop see Annexure 3.

#### 4.3.1. Day 1 (8 September 2008)

Day one of the Kiribati Tsunami Capacity Assessment workshop was attended by 31 participants.

Mr. Kietau Tabwebweiti, the Kiribati Parliamentary Secretary for the Ministry of Communications, in his opening speech workshop thanked AusAID and all organisations involved in the assessment. He spoke of the significant contribution this process could provide in raising levels of confidence and trust in services delivered within Kiribati. He also referred to the susceptibility of low-lying island nations to sea level rise and tsunami, reiterating that Kiribati had never experienced a tsunami impact and had no strategy in place to deal with this type of disaster.

The Parliamentary Secretary for the Office of the President in his presentation described the limited progress to realise the objectives of the Kiribati National Disaster Act (D1), including the formation of a National Disaster Council (convened on ad hoc basis for disease epidemics such as dengue fever outbreaks, water issues and the recent food crisis triggered by rising prices). He also highlighted the need for improved satellite communications systems and challenged the workshop to come up with ideas for a more responsive warning system for Kiribati.

Questions after the presentation on tsunami risk in Kiribati focussed on subterranean volcanoes, seabed mining and weapons as other potential tsunami sources. A trench near Canton and Kiritimati Islands was mentioned as a possible local tsunami source. There was discussion of the potential cross-over between sea level rise and tsunami interests, for example, mitigation activities (mangrove planting, coastal protection) and public education. Also the accuracy of modelling of the height and timing of tsunami affecting Kiribati was discussed.

The focus group session was successful in identifying Kiribati's priorities for improved tsunami warning and mitigation system. An anecdote that emerged from one focus group relates to large rocks being washed-up onto the islands of Tamana and Makin. There are also stories describing two series of three "magic waves" one of which was responsible for moving the boulders to their current position.

#### **4.3.2. Day 2 (9 September 2008)**

Day two of the Kiribati Tsunami Capacity Assessment workshop was attended by 25 participants.

Most of the Tsunami Capacity Assessment Questionnaire generic questions were completed by the end of the second day, to allow participants to review the answers and comment overnight. Some specific details relating to the activities of the KMS and government legislation could not be answered in session due to the absence of the Chief Meteorological Officer and representatives of the OB and the Office of the Attorney-General at various times during the first two days.

The team presentations on tsunami warning systems and communications prompted questions about whether advice was received in Kiribati at the time of the Solomon Islands earthquake and tsunami in 2007, how much time would be available before tsunami impact in the case of a nearby earthquake, and the lack of a safe refuge from tsunami on low-lying islands.

Useful information was gained about available communication systems for dissemination of tsunami warnings, public education activities after the Solomon Islands tsunami and progress of GIS mapping of significant infrastructure as well as bathymetric and topographic surveys. Discussions also included recent felt earthquakes in the southern islands, one resulting in a large crack in a reef, as well as a report of an unusual two foot high wave in 1998. Traditional means of understanding natural hazards was also discussed.

#### **4.3.3. Day 3 (10 September 2008)**

Day three of the Kiribati Tsunami Capacity Assessment workshop was attended by 19 participants. Participants gathered to review the draft responses to the questionnaire. Secretary Enota Ingintau provided the team with a copy of the current National Disasters Act 1993 (D1) and the Local Government Act (2006) (D12). Considerable discussions were held around the application of those laws at a national, council and village level. Participants then reviewed and discussed the individual responses, recommendations and updated the questionnaire.

#### **4.3.4. Visits**

In order to increase their understanding of the capabilities of Kiribati's tsunami warning and mitigation system the Visiting Assessment Team visited the Kiribati Adaptation Project (KAP) office, the KMS office (including inspection of the seismometer and communications equipment at KMS) and the sea level gauge at Betio wharf. The team also visited the Australian High Commission in Tarawa to brief them on the Tsunami Capacity Assessment Workshop.

#### 4.4. Workshop Photos (Tarawa September 2008)



Tsunami Capacity Assessment Workshop participants



The workshop in progress



Mr Enota Ingintau presents on tsunami monitoring and response in Kiribati



Workshop participants partake in refreshments



Workshop participants share lunch





## 5. Assessment Results



## 5. Assessment Results

### 5.1. Status of Key System Components

The Tsunami Capacity Assessment Workshop results are summarised below in Table 4 in which the status of key components of the Kiribati tsunami warning and mitigation system are outlined (as at the date the Tsunami Capacity Assessment Workshop was held in September 2008, updates between then and the publication of this report are as marked).

**Table 4: Summary of current status of key components of Kiribati's tsunami warning and mitigation system as at September 2008.**

#### Rating

Yes - fully realised
Partially realised
No - not realised

Key Component	Rating	Comment
<b>Authority, Coordination and NGO Role</b>		
Legislation in place for tsunami warnings and response	<b>Yes</b>	Legislative framework for Disaster Risk Management in place since 1993 (National Disaster Act, D1). Tsunami is included as a potential disaster in the National Disaster Act.
Tsunami coordination committee or effort at a National and local level	<b>Partially</b>	Ad hoc National Disaster Council established to advise the Minister (has convened for disease epidemics, water issues and food crisis). Members are nominated by the Minister. Disaster Risk Management structures at the national, council and village level need to be formalised.
Agency responsibilities clearly defined	<b>No</b>	There is a recognised requirement for a National Disaster Plan. Scope for this plan is defined in the National Disaster Act. Emergency response, evacuation and recovery plans do not currently exist.
NGOs and Red Cross Society have a defined role in tsunami warning dissemination, preparedness and awareness and emergency response	<b>No</b>	The Red Cross (along with the Police) are the only agencies with any disaster management capability.



Key Component	Rating	Comment
<b>International and Regional Cooperation</b>		
Country represented at an international and regional level to aid cooperation in tsunami warning and mitigation efforts	<b>Partially</b>	<p>Kiribati is a SOPAC Member Country and cooperates on a number of projects and initiatives with international organizations such as PTWC, National Institute of Water and Atmospheric Research (NIWA) and AusAID, particularly with regard to climate change adaptation.</p> <p>Kiribati is not currently actively involved in the PTWS Southwest Pacific Working Group and it is not a member of the IOC.</p>
<b>Priorities</b>		
Priorities established for implementation of tsunami warning and mitigation system at a National level	<b>Partially</b> (through the tsunami assessment process)	<p>Priorities for the implementation of an effective tsunami warning and mitigation system in Kiribati were outlined in this Tsunami Capacity Assessment workshop. High priorities identified in the workshop are outlined below:</p> <p>Emergency Response Planning:</p> <ul style="list-style-type: none"> <li>• Improved planning for extreme weather events including flooding etc., sea wall destruction, fresh water management, infrastructure breakdown.</li> </ul> <p>Community Awareness:</p> <ul style="list-style-type: none"> <li>• Include tsunami education in schools as part of primary and secondary geography curriculum.</li> <li>• Include tsunami awareness in Church community education efforts.</li> <li>• Government led community education required to explain tsunami and action to be taken in the event of a tsunami warning for Kiribati (e.g. safe places (still to be identified) and likely impacts on each island (still to be identified)).</li> <li>• Education using electronic media (radio and television).</li> <li>• Posters teaching about natural disasters.</li> </ul> <p>Interagency Cooperation:</p> <ul style="list-style-type: none"> <li>• Further interagency cooperation (possibly through a coordination committee) on search and rescue, public awareness, survival at sea and media information.</li> <li>• Better use and coordination through Island Councils and the Red Cross.</li> </ul>



Key Component	Rating	Comment
<b>Priorities (Continued)</b>		
Priorities established for implementation of tsunami warning and mitigation system at a National level	<b>Partially</b> (through the tsunami assessment process)	<p>Risk Assessment and Warning Dissemination:</p> <ul style="list-style-type: none"> <li>• Enhance communications systems by:</li> <li>• Funding RANET license.</li> <li>• Reinstating Emergency Managers Weather</li> <li>• Information Network (EMWIN) receiver.</li> <li>• Extending Telecom Services Kiribati Limited</li> <li>• (TSKL) telephone links.</li> <li>• Coordinating CB radio network.</li> <li>• Providing radios for all villages.</li> <li>• Providing Police with portable radios.</li> <li>• Providing television to all islands (currently south Tarawa only).</li> </ul>
<b>Multi-hazard Approach</b>		
Tsunami warning capabilities are being established within a multi-hazard framework	<b>Partially</b>	Tsunami warning and mitigation capabilities are being addressed in a multi-hazard framework through the National Disaster Act 1993 (D1). National Disaster Council has convened for disease epidemics, water issues and food crisis.
<b>Research Expertise</b>		
Active research is being undertaken within the country for seismology and tsunami to strengthen the tsunami warning and mitigation system	<b>Partially</b>	<p>Limited active researchers or government research organisations involved in in-country scientific research on seismology, tsunami or products and services to strengthen Kiribati's tsunami warning and mitigation system (aside from the Kiribati Department of Fisheries Licensing Unit who study oceanography, including tsunami).</p> <p>A number of international studies exist, largely focused on climate change.</p>
<b>Tsunami monitoring infrastructure</b>		
Existence of seismograph stations and integration of real time data from these stations into the tsunami warning process	<b>Partially</b>	One seismic station is hosted at KMS and operated by United States Geological Survey (USGS). Kiribati has no real-time data access to this station but can request post-event data from USGS.

Key Component	Rating	Comment
<b>Tsunami monitoring infrastructure (Continued)</b>		
Existence of sea level stations and integration of real time data from these stations into the tsunami warning process	<b>Partially</b>	One coastal sea level monitoring station exists at Betio Jetty in Kiribati operated by the Bureau. Meteorological and sea level data is displayed at KMS.
Sharing of seismic and sea level data internationally to facilitate improvement of PTWC tsunami messages for the region	<b>Yes</b>	Data from stations available to international community for seismic and tsunami related purposes.
<b>Warnings</b>		
Nation receives PTWC messages	<b>Partially</b>	KMS receives PTWC messages via phone call to the Chief Meteorological Officer, e-mail and EMWIN (when functioning). Receipt of these messages is not alarmed in the KMS office.
24/7 operational staff at warning receipt and dissemination location	<b>Partially</b>	KMS role is to relay warning to the OB only if Kiribati is mentioned in the PTWC message. This is currently completed manually. No 24/7 operational staff at OB.
Disseminate national tsunami warnings as guided by a Standard Operating Procedure	<b>No</b>	No local interpretation of PTWC warnings is undertaken, including issuing of public advice. No standard operating procedures currently exist.
System redundancies in place for receipt of PTWC messages and dissemination of National warnings	<b>No</b>	There is no 24/7 agency backing up KMS for the receipt of tsunami warnings from PTWC. Communications systems outages at KMS compromise operations. There is a lack of built-in redundancy.
Redundant 24/7 methods available for dissemination of warnings to community (e.g. public radio, sirens etc.)	<b>Partially</b>	Media broadcasting services and OB are not 24/7. Lack of defined use of warning mediums and lack of coordination between government agencies, church, NGOs and media who have the capability to inform communities of disaster warnings. Possibilities in future include a variety of radio networks capable of delivering alerts, sirens, horns, church bells and word of mouth. Expanding telephone network and planned mobile network with enhanced messaging services.

Key Component	Rating	Comment
Effective warning dissemination to remote communities	No	Refer above. Kiribati's telecommunications systems allow for some possible solutions for disseminating warning information over distances, these are generally not suitable for getting the warning information to communities in remote or outlying areas where the infrastructure does not exist or is not reliable.
Communications coverage of whole country that is effectively utilised for the dissemination of tsunami warning messages	No	Current radio communication technologies are the key communications coverage in Kiribati. Lack of technical expertise, equipment and funding.
<b>Warnings (Continued)</b>		
Issue of marine tsunami warnings and guidance for vessels, harbours and ports	No	No procedures are in place for marine tsunami warnings at present.
<b>Emergency Response and Evacuation</b>		
Disaster preparedness and emergency response system has been reviewed and opportunities for improvement and training identified	No	No reviews have been undertaken aside from the National Disaster Act 1993 (D1) which establishes command and control arrangements for managing a range of disasters from tsunami, other natural and man made disasters.
Tsunami emergency response, evacuation and recovery plan exists	No	Emergency response, evacuation and recovery plans do not currently exist.
The designated agency for evacuation is identified and have authority by law	Yes	Police designated as the authority for disaster evacuation (under orders issued by the OB). This is including the outer islands.
Plans have been made for safe evacuation of population centres including aspects such as maps, routes and signage	No	No tsunami evacuation maps, evacuation routes, and evacuation signage have been developed. No assessment has been made of lead times for safe evacuations of communities in the event of a tsunami. The National Disaster Act 1993 (D1) provides for government and NGOs to make such plans.
Procedures are tested and exercised to improve the response through better planning and preparedness	No	Every two years an exercise is conducted but only for aviation incidents and no other testing or exercises have been carried out.

Key Component	Rating	Comment
<b>Emergency Response and Evacuation (Continued)</b>		
Land use policies and building codes are in place to mitigate against the tsunami hazard	<b>Partially</b>	<p>Policies to mitigate sea level rise provide some tsunami mitigation.</p> <p>Responsible agencies are nominated:</p> <ul style="list-style-type: none"> <li>• Lands Management Division - responsible for the foreshore and land use planning.</li> <li>• The Ministry of Public Works and Utilities - also responsible for coastal infrastructure planning and protection (water, roads, sea walls, government buildings).</li> <li>• Councils – regulation and control of private and public buildings under the Local Government Act 2006 (D12).</li> </ul> <p>Planning ordinance currently exists.</p> <p>However, these agencies and measures do not currently consider tsunami mitigation. Better enforcement is needed.</p>
<b>Tsunami hazard, vulnerability and risk</b>		
Completion of studies to assess the tsunami hazard in the country or Region	<b>Partially</b>	A “Preliminary Study into the Tsunami Hazard faced by Southwest Pacific Nations” (D25) and a “Probabilistic Tsunami Hazard Assessment of the Southwest Pacific Nations” (D27) have been completed.
Local risk assessments have been completed for at risk communities	<b>No</b>	No local tsunami risk assessments have been carried out.
Adequate data exists and local inundation modelling has been completed for population centres	<b>Partially</b>	<p>Inundation data available for some locations in South Tarawa for sea level rise scenarios for 2050 and 2100 from IPCC assessments (World Bank 2000 study on climate change adaptation), using local surveys by the Lands Department.</p> <p>Bathymetric and topographic surveys in limited areas have been conducted and incorporated into sea level rise impact assessments.</p> <p>Inventory of Geospatial Data and Options for Tsunami Inundation and Risk Modelling has been completed (D26).</p>
<b>Public and Stakeholder Awareness, Education and Training</b>		
Measures have been taken to ensure the public understand and take action in the event of a tsunami warning being issued	<b>No</b>	<p>No tsunami preparedness information currently provided in school curriculum or by public education campaigns.</p> <p>Community needs to know what to do – safe places (still to be identified) and likely impacts on each island needs to be identified.</p> <p>Kiribati communities need to be educated as to how government and NGOs will respond to those emergencies from which they are at risk.</p>

Key Component	Rating	Comment
<b>Public and Stakeholder Awareness, Education and Training (Continued)</b>		
Community level education and preparedness programs exist for tsunami	<b>Partially</b>	Some media coverage (post Solomon Islands tsunami in April 2007) and education (tsunami education kit specific to Kiribati). Limited penetration of these programs to date.
Training programs for the National media exist for natural hazard and tsunami	<b>No</b>	No training programs for media on tsunami or other hazards have been undertaken.
Training programs exist for officials involved in tsunami warning and response	<b>Partially</b>	Disaster Management capability and training across other agencies (aside from Police and Red Cross) is limited. Financial and human resources are an issue. KMS tsunami training is limited.

## 5.2. Case Study – Tsunami System Operation in Kiribati for the April 2007 Solomon Islands Tsunami Event

Throughout the Tsunami Capacity Assessment Questionnaire completed in Kiribati, the country's response to the Solomon Islands event of April 2007 was reviewed. The aim of this review was to gain an understanding of the operation of the system in a real time event.

### **Event Details: Solomon Islands**

Magnitude 8.1

45km south-southeast of Gizo (Solomon Islands)

20:39:56 Coordinated Universal Time (UTC)

Sunday 1 April 2007 (2 April, 10:39am Kiritimati local time)

Kiribati was specifically warned by PTWC in Tsunami Bulletin Number 003 issued at 2239 UTC, 1 April 2007 (2 April, 12:40pm Kiritimati local time). The warning continued through Tsunami Bulletin Number 004, 005 and 006 and was cancelled in Tsunami Bulletin Number 008 at 0405 UTC, 2 April 2007 (2 April, 6:05pm Kiritimati local time)

For this event the PTWC bulletin was not received by Kiribati. Kiribati was added to PTWC list in 2007, after the event in question. Kiribati therefore did not issue any national tsunami warnings for this event. There was no public awareness or response to the event. Kiribati did not have a national tsunami response plan in place at the time of the event.

The KMS had no knowledge of event detection (either seismic or sea-level) in real time. The one seismic station hosted at KMS and operated by USGS and the Betio Jetty sea-level station (operated by the Bureau) were both in operation at the time.

### 5.3. Strengths, Opportunities for Improvement and Recommendations to Progress the Tsunami Agenda in Kiribati

Based on the discussions during the workshop with in-country participants and the supporting documentation collected during the visit, the visiting team, in consultation with Tsunami Capacity Assessment workshop participants formulated the following strengths, opportunities for improvement and recommendations under key topics which they believe will progress the tsunami agenda in Kiribati. These are outlined in Table 5.

**Table 5 –Strengths, opportunities for improvement and recommendations under key topics**

<b>5.3.1. Governance and Coordination</b>	
<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Legislative framework for Disaster Risk Management in place since 1993 (National Disaster Act, D1). This demonstrates Kiribati government has recognised the need for DRM. The National Disaster Act is also supported by the Local Government Act 2006. Meteorological Service are covered by 2004 legislation.</li> <li>• Tsunami warning and mitigation capabilities are being addressed in a multi-hazard framework through the National Disaster Act 1993 (D1).</li> <li>• Tsunami is included as a potential disaster in the National Disaster Act 1993 (D1).</li> <li>• Ad hoc National Disaster Council established to advise the Minister (has convened for disease epidemics, water issues and food crisis). Members are nominated by the Minister.</li> <li>• KANGO (coordination of NGOs, civil societies, community groups, churches and the Red Cross) plays an important role in the community and is useful for dissemination of information.</li> <li>• 23 island based Local Government Council's exist under the Ministry of Internal and Social Affairs. (Local Government Unit of the Ministry of Internal and Social Affairs are responsible for island councils and village committees).</li> <li>• Local Government Act 2006 makes provision for development of Special Area Committees which can be appointed by local councils and have authority within the council area.</li> </ul>	<ul style="list-style-type: none"> <li>• Many provisions in the National Disaster Act 1993 (D1) have yet to be adequately resourced.</li> <li>• Disaster management plans for relevant agencies at all levels have yet to be formulated.</li> <li>• Detailed operational plans and SOPs need to be compiled and tested at a national, council and village level.</li> <li>• Disaster Risk Management structures at the national, council and village level need to be formalised. The National Disaster Act 1993 (D1) provides the legislative framework for development of these structures.</li> <li>• Recognised requirement for the establishment of the NDMO. Plans exist to develop this office under the OB as well as a Strategic National Policy and Risk Assessment Unit.</li> <li>• Recognised requirement for the establishment of Disaster Committees within the Local Government Councils.</li> <li>• Improved relationships and coordination between government agencies is required.</li> <li>• Recognised requirement for a National Disaster Plan. Scope for this plan is defined in the National Disaster Act 1993 (D1). A DRM National Strategy exists but needs more work.</li> </ul>

***Governance and Coordination (Continued)*****Recommendations:**

1. Formalise establishment of the National Disaster Council in accordance with the provisions of the National Disaster Act 1993 (D1).
2. Complete and implement a strategic National DRM Plan including prevention (mitigation), preparedness (planning and training), response (plan activation) and recovery (immediate and long term). Commence development of sub-plans relevant to each hazard with the potential to affect Kiribati (including tsunami).
3. Commence discussions with Local Government Councils throughout Kiribati to establish Disaster Committees to ensure comprehensive and community integrated DRM including the development of Council and Village DRM Plans (supporting the National DRM Plan).
4. Require government agencies, NGOs and key private sector organisations to develop their own Disaster Risk Management Plans for their areas of responsibility. If required, enhance legislation to make this a requirement.

***5.3.2. Regional and International Coordination*****Strengths:**

- Kiribati is a SOPAC Member Country.
- Kiribati cooperates on a number of projects and initiatives with international organizations such as PTWC, NIWA and AusAID, particularly with regard to climate change adaptation.
- KMS coordinates with Regional Specialised Meteorological Centre (RSMC) Nadi, Fiji for weather related forecasts and warnings.
- For emergency response, Kiribati participates in formal arrangements of the South Pacific Police Officer's Forum.
- Donations were provided to the Solomon Islands (2 April 2007 tsunami) through the Kiribati National Council of Churches.

**Opportunities for Improvement:**

- Kiribati is not currently actively involved in the PTWS Southwest Pacific Working Group or is not a member of the IOC.
- Kiribati does not currently cooperate with neighbouring countries to evaluate earthquakes and monitoring tsunami in real time, or for tsunami warning services, or other mitigation activities.

**Recommendations:**

5. Participate in the PTWS Southwest Pacific Working Group by nominating a representative of Kiribati to be on this working group. Use this group to learn about regional initiatives and initiatives of other PICs with regard to tsunami warning and mitigation systems in remote and low lying islands.
6. Build on existing climate change adaptation relationships with international and regional bodies to incorporate DRM initiatives where appropriate.
7. Become a member of the IOC to ensure Kiribati has a voice in determining IOC programmes and activities of benefit nationally as well as benefiting from IOC capacity building in marine science.



### 5.3.3. *Research Expertise*

<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Synergies for tsunami exist with sea level rise studies, mitigation and public education. For example, in KAP II project (D3).</li> <li>• The Kiribati Department of Fisheries Licensing Unit study oceanography, including tsunami.</li> <li>• Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and National Oceanic and Atmospheric Administration (NOAA) conduct sea floor research.</li> </ul>	<ul style="list-style-type: none"> <li>• Limited active researchers or government research organisations involved in in-country scientific research on seismology, tsunami or products and services to strengthen Kiribati's tsunami warning and mitigation system.</li> </ul>
<b>Recommendations:</b>	
<ol style="list-style-type: none"> <li>8. Proactively encourage and actively cooperate with regional and international organisations that can assist with conducting scientific research and building technical capacity building in Kiribati. Ensure this research and capacity building is conducted in line with Kiribati's national sustainable development priorities and that a protocol is developed to ensure copies of scientific research reports and data are provided to Kiribati.</li> </ol>	

### 5.3.4. Tsunami Monitoring Infrastructure

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> <li>• One seismic station is hosted at KMS and operated by USGS. Kiribati has no real-time data access to this station but can request post-event data from USGS. Data is used by the international community for seismic and tsunami related purposes.</li> <li>• One coastal sea level monitoring station exists at Betio Jetty in Kiribati operated by the Bureau. Meteorological and sea level data is displayed at KMS.</li> <li>• The coastal sea level monitoring station (an Aquatrack sensor) reports at one minute intervals and is relayed via a satellite communications link (THISS StreamSat, NOAA Data Collection Platform and Iridium) to the GTS. Data therefore contributes to international tsunami related purposes.</li> <li>• Kiribati Port Authority and KMS assist in the maintenance of the equipment outlined above.</li> </ul>	<ul style="list-style-type: none"> <li>• Real time access to sea level data from Kiribati and the wider Pacific would facilitate verification and assist in early warning of the tsunami threat.</li> </ul>
<b>Recommendations:</b>	
<ol style="list-style-type: none"> <li>9. Investigate access to and training in the interpretation of Pacific sea level data at KMS via the GTS or the Bureau Registered User Website to assist in tsunami verification and early warning.</li> </ol>	

### 5.3.5. Tsunami Warnings

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> <li>• KMS translates forecasts from RSMC (Nadi, Fiji) for broadcast within Kiribati. This includes Marine forecasts, which are relayed by KMS to the Marine Division twice a day. The Marine Division then relays these forecasts (and warnings if warnings are current) to ships.</li> <li>• KMS operates 24/7 and can receive and disseminate warnings after contact with OB.</li> <li>• KMS receives PTWC messages via phone call to the Chief Meteorological Officer, e-mail and EMWIN (when functioning). Receipt of these messages is not alarmed in the KMS office.</li> <li>• KMS was identified as a suitable focus agency for the receipt of tsunami messages from PTWC and the dissemination of national warnings through relevant authorities.</li> <li>• KMS has good e-mail, fax and radio communication links but EMWIN and RANET were not functioning at the time of the assessment.</li> </ul>	<ul style="list-style-type: none"> <li>• Tsunami warning to the last mile is difficult given the geographical distribution of small islands across a large expanse of ocean. Improved mechanisms for getting warning information to all villages that are exposed to potential natural hazards requires improvement.</li> <li>• There is an intention to establish a National Tsunami Warning Centre operating under the OB. KMS would then forward tsunami messages to this office. Kiribati need to consider whether this is the most efficient use of resources as this approach would involve replication of resources on a level equal to KMS, including a 24/7 roster.</li> <li>• Media broadcasting services and OB are not 24/7.</li> <li>• There is no 24/7 agency backing up KMS for the receipt of tsunami warnings from PTWC.</li> <li>• Current procedures are minimal and require review. KMS role is to relay warning to the OB only if Kiribati is mentioned in the PTWC message. This is currently completed manually. No local interpretation of PTWC warnings is undertaken, including issuing of public advice.</li> <li>• No procedures are in place for marine tsunami warnings.</li> </ul>
<p><b>Recommendations:</b></p>	
<ol style="list-style-type: none"> <li>10. That full authority and responsibility for analysing and interpreting tsunami messages and data and issuing tsunami warnings for Kiribati be formally delegated to KMS.</li> <li>11. KMS, in consultation with OB and other key stakeholders, develop SOPs for the operation of Kiribati's tsunami warning service. This should include a pre-agreed warning decision making matrix outlining what action will be taken by key agencies for each PTWC message and what public advice will be issued.</li> <li>12. Ensure KMS staffing levels are maintained at level sufficient to effectively run 24/7 operations as well as being adequately resourced to operate all communications systems available to KMS to ensure redundant capability.</li> <li>13. Nominate, resource and ensure procedures are in place for a second 24/7 agency to receive PTWC messages as a backup to KMS.</li> </ol>	

### 5.3.6. Communications

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> <li>• Variety of government, church and NGO radio networks available throughout Kiribati. Police and the Ministry of Health have HF radio systems that can be used for emergency communications. Public Works have a radio network to island clerks that can be used to communicate information to and from local communities. Kiribati European Union project supports data transfer to and from outer islands on HF.</li> <li>• Strong village level social and church networks provide means of information dissemination including old men's network, women groups, youth groups and church groups.</li> <li>• Sirens (Police and public address systems on vehicles available in Tarawa only), horns, church bells and word of mouth are possible means of information dissemination. Solutions will vary for different islands.</li> <li>• Radio reaches the majority of people in Kiribati in waking hours. Radio operates from 6:30am to 9:30pm using Amplitude Modulated (AM) on Tarawa and Frequency Modulated (FM) on Christmas Island. OB and Police emergency announcements can be made on radio by interrupting normal programming. Radio Kiribati (Government) responsible for AM radio and FM in Kiritimati.</li> <li>• Kiribati TSKL mobile network supports text messaging. An upgrade to 3G is planned for 2008. Digicel mobile company to introduce new mobile service when licensed which will support text, broadcast and e-mail with coverage on Tarawa, Christmas Island and outer islands.</li> <li>• Television 1000 viewers (Tarawa satellite decoder required). Need TV satellite and generator.</li> <li>• TSKL provides Internet access via satellite downlink.</li> <li>• KMS has EMWIN down awaiting repair, RANET switched off due to frequency licensing costs, GTS messages sent and received from New Zealand, facsimile no longer used. No Aeronautical Fixed Telecommunication Network (AFTN).</li> <li>• Telecommunications authority has some Iridium satellite phones. A licence is required. A database of these numbers is kept only for licensing purposes.</li> </ul>	<ul style="list-style-type: none"> <li>• Potential for delays to occur due to difficulty in contacting key decision makers out of hours</li> <li>• Communications systems outages at KMS compromise operations. There is no built-in redundancy.</li> <li>• Broadcast radio limited to 6:30am to 9:30pm.</li> <li>• No free to air broadcast television service.</li> <li>• Limited coordination between a variety of government agencies, church, NGOs and media who have the capability to inform communities of disaster warnings.</li> <li>• Lack of defined use of sirens, bells, public address systems for warnings.</li> <li>• Communications infrastructure does not exist or is not reliable in remote outlying areas.</li> <li>• A need for improved radio and satellite communications systems was recognised.</li> <li>• Lack of technical expertise, equipment and funding.</li> <li>• No central database of satellite phone numbers is kept for disaster management purposes.</li> <li>• <b>Note</b> - Telecommunications Authority of Kiribati (TAK) and TSKL did not participate in the workshop and representatives were not available to elaborate on some of the questions. TAK (Government Company) responsible for television and Internet along with TSKL.</li> </ul>

***Communications (Continued)*****Recommendations:**

14. Investigate feasibility of activating radio stations to disseminate information outside normal hours of operation.
15. Coordinate government agencies, churches, NGO radio networks to assist in spreading information to public.
16. Coordinate use of police and ambulance sirens, church bells to alert public.
17. Review TV licensing arrangements to allow warnings.
18. Review satellite and radio telecommunication licensing fees to facilitate development of better communications systems.
19. Investigate available practical and sustainable technology solutions, such as the RANET Chatty Beetle to aid in dissemination of warning messages to remote communities, particularly outside of waking hours.

**5.3.7. Tsunami Emergency Response (including evacuation)**

<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Police designated as the authority for disaster evacuation (under orders issued by the OB) and response with support from bodies such as the Aircraft Rescue and Fire Fighting (ARFF). On outer islands, local police can issue evacuation instructions to the community.</li> <li>• Resilient culture of constant adaptation to changes.</li> <li>• National Disaster Act which establishes command and control arrangements for managing a range of disasters from tsunami, other natural and man made disasters.</li> <li>• If a Public Emergency is declared the Beretitenti has special powers relating to the protection of life and property pursuant to Section 16 of the Kiribati Constitution.</li> <li>• The NDMO has delegated authority by the Minister to carry out Disaster Management and other responsibilities through the National Disaster Act 1993 (D1).</li> <li>• Red Cross disaster response plan exists.</li> <li>• GIS is used in Kiribati by a number of parties (Lands Department, Department of Health, Ministry of Public Works and Utilities, Public Utility Board) for varying purposes (coastal monitoring, land management, cultural sites, mapping housing, mapping water supply).</li> <li>• Every two years an aviation exercise is conducted but no other testing or exercises have been carried out.</li> <li>• Critical infrastructure has been identified with regard to coastal erosion risk.</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of safe refuge from tsunami on most of Kiribati's low-lying islands.</li> <li>• Emergency response, evacuation and recovery plans do not currently exist.</li> <li>• No tsunami evacuation maps, evacuation routes, and evacuation signage have been developed. No assessment has been made of lead times for safe evacuations of communities in the event of a tsunami.</li> <li>• Tsunami signage would be considered and would need to be customised on an island by island basis.</li> <li>• Recognised requirement for Central Operations Group for operational disaster tasks.</li> <li>• No local plan in place to guide the community in what action it must take on receipt of the warning information.</li> <li>• Consideration needs to be given to people with special needs (hearing impaired, blind, and elderly) that are cared for by the family. These people may be more vulnerable to disasters.</li> </ul>
<b>Recommendations:</b>	
<ol style="list-style-type: none"> <li><b>20.</b> Establish a Central Operations Group to oversee the effective allocation of operational tasks and resources during an operational event as well as an appropriately located and resourced NEOC.</li> <li><b>21.</b> Resource the NDMO to effectively carry out DRM (including Disaster Risk Reduction and Disaster Management coordination roles).</li> <li><b>22.</b> Incorporate into the tsunami sub-plans a regime for the regular multi-stakeholder test of the tsunami warning and response arrangements including a post event debrief.</li> <li><b>23.</b> In consideration of Kiribati's low lying nature, consider and make plans for the safe evacuation of at risk communities. Options may include moving inland and vertical evacuation. Include consideration of evacuation shelters, maps, signage and drills.</li> </ol>	

**5.3.8. Tsunami Hazard, Vulnerability, Risk and Mitigation**

<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>● Acute awareness of the susceptibility of low lying atolls to rising sea levels and the potential for tsunami inundation exists.</li> <li>● Risk assessment and GIS mapping of significant infrastructure has progressed at pilot locations on south Tarawa, using inundation scenarios provided in the World Bank 2000 study on climate change adaptation (IPCC scenarios for 2050 and 2100).</li> <li>● Bathymetric and topographic surveys in limited areas have been conducted and incorporated into sea level rise impact assessments.</li> <li>● Wave inundation modelling for Kiribati has been conducted by NIWA in conjunction with the Kiribati Department of Lands and Fisheries. Tools for inundation modelling have been made available to a variety of users. This was in relation to waves overtopping atolls and will be used for planning height and location of sea-walls.</li> <li>● Sea walls have been constructed to prevent coastal erosion. New sea wall designs being developed (KAP) to resist rising sea level.</li> <li>● Mangrove preservation and replanting is progressing for coastal protection.</li> <li>● A “Preliminary Study into the Tsunami Hazard faced by Southwest Pacific Nations” (D25) and a “Probabilistic Tsunami Hazard Assessment of the Southwest Pacific Nations” (D27) have been completed.</li> <li>● Historical events affecting Kiribati can be found in D26 Appendix 2. This information is an extract from the National Geographic Data Centre (NGDC) Tsunami data base.</li> <li>● Some earthquake and tsunami events have been reported in-country in the early 1980s. Tamana reported an event with a resulting crack on the reef.</li> <li>● The KAP (KAP II: Component 1.3.2) has produced a technical guide to Risk Identification and Risk Analysis: Towards Coastal Risk Hazard Diagnosis for Republic of Kiribati Case Study Sites (refer to D9).</li> <li>● Inventory of Geospatial Data and Options for Tsunami Inundation &amp; Risk Modelling has been completed (D26).</li> <li>● Local GIS expertise exists.</li> </ul>	<ul style="list-style-type: none"> <li>● No local tsunami risk assessments have been carried out. Some bathymetric and topographic data available for tsunami inundation modelling specific to Kiribati.</li> <li>● Need to develop a realistic understanding of the actual risk that specific communities face.</li> <li>● Current and future impacts of rising sea level and global warming on low lying atolls mean that the government is actively considering future relation of residents from the Tarawa atoll to other countries in the region.</li> <li>● The work done by KAP on inundation modelling, public education and mitigation strategies shares common issues with tsunami risk assessment and provides an opportunity for further in-country collaboration.</li> <li>● There are currently no government agencies responsible for identifying tsunami hazard and risk.</li> <li>● Responsible agencies are nominated for land management:</li> <li>● Lands Management Division - responsible for the foreshore and land use planning.</li> <li>● The Ministry of Public Works and Utilities - also responsible for coastal infrastructure planning and protection (water, roads, sea walls, government buildings).</li> <li>● Councils – regulation and control of private and public buildings under the Local Government Act 2006 (D12).</li> <li>● Planning ordinance currently exists. However, these agencies and measures do not currently consider tsunami mitigation. Better enforcement is needed.</li> </ul>

*Tsunami Hazard, Vulnerability, Risk and Mitigation (Continued)***Recommendations:**

24. Use the tsunami hazard studies completed for the Southwest Pacific Nations to date, historical records, GIS data and deep ocean models to identify low-lying communities potentially at tsunami risk. Commence tsunami mitigation planning using this and local knowledge.
25. Capitalise on climate change studies to acquire the necessary high resolution topography and bathymetry data for centres at risk of tsunami as part of a multi-hazard mapping activity. This data can then feed into hazard assessments, modelling and mapping for hazards including climate change, tsunami and storm surge.
26. Investigate future, long term options for completing tsunami inundation modelling in partnership with regional and international bodies, particularly for population and infrastructure centres.

**5.3.9. Public and Stakeholder Awareness, Education and Training****Strengths:**

- There are several public awareness programs under the Ministry of Internal and Social Affairs which could be used as models for tsunami educational activities e.g: health, social issues and climate change.
- Media coverage of recent tsunami events in region. TAK periodically produces public awareness programs – health, road safety, natural hazards, social problems.
- Public education activities after the Solomon Islands tsunami included a live television talk show, the incorporation of tsunami into public consultations on climate change impacts and the production of an education video kit. The kit is available on request but not broadly distributed.
- KAP is promoting consultation about climate change issues in outer islands, targeting youth and women.
- Earthquakes and tsunami are included in current school curricula, but no preparedness information is taught.
- Two tsunami workshops have been undertaken in country. Reports from these workshops were not held in-country. SOPAC tsunami workshop in 2000 and USAID tsunami workshop in 2002.
- Traditional knowledge of weather held by local navigators and is published in the cultural museum. Animal behaviour foretells weather and other changes.
- Police disaster management training programs exist. The Red Cross also has some disaster management capability.

**Opportunities for Improvement:**

- No comprehensive tsunami public awareness program in place. Public awareness of tsunami is limited.
- No tsunami preparedness information currently provided in school curriculum or by public education campaigns. Community needs to know what to do – safe places (still to be identified) and likely impacts on each island needs to be identified.
- Kiribati communities need to be educated as to how government and NGOs will respond to those emergencies from which they are at risk.
- No training programs for media for tsunami or other hazards have been undertaken.
- Museums and other cultural institutions have a role in public awareness education. This could be expanded upon to include tsunami.
- More educational materials are needed including brochures, posters etc. in local language. The tsunami kit is available on request. Would benefit from being more widely publicised and distributed.
- Disaster Management capability and training across other agencies (aside from Police and Red Cross) is limited. Financial and human resources are an issue.



***Public and Stakeholder Awareness, Education and Training (Continued)*****Recommendations:**

- 27.** Expansion of earthquake and tsunami school curriculum to include tsunami preparedness (warning process and action to take).
- 28.** Expansion of the current tsunami education initiatives to include a multi-government and NGO approach and incorporate tsunami education into a multi-hazard education framework. Include expansion of tsunami awareness kit distribution, incorporation of education into the monthly meetings of Island Councils and consideration of media multi-hazard education.
- 29.** That a tsunami capacity development / training program be developed, including training and exercising for emergency managers, NGOs and KMS staff and that this be done in a competency-based framework.

## 5.4. Additional Workshop Benefits

- In addition to this report, benefits of the tsunami capacity assessment workshop in Kiribati were:
- Improved understanding and documentation of capacity in Kiribati to receive and respond to tsunami warnings;
- Enhanced working relationships with counterparts and associated agencies and organisations;
- Exchanged information on respective activities and capabilities;
- Open exchange of information on community awareness and preparedness planning as well as implementation and emergency response amongst workshop participants; and
- Enhanced working relationships between the Kiribati participants, the Bureau and AGD.

## 5.5. Next Steps

Kiribati will receive three key material outcomes from the Tsunami Capacity Assessment project:

1. The completed questionnaire in electronic format with scanned copies of all supporting documentation collected in-country;
2. A comprehensive National Report in a standard format which aims to summarise information collected from the visits and is consumable for non-technically minded recipients (this document); and
3. A copy of the final Regional Report which will outline common themes across the region.

At the agreement of the country project results will be posted on websites such as the Bureau and Pacific Disaster Net.

Once approved by the country the Bureau will facilitate dissemination of reports to regional and international donors and other stakeholders to ensure maximum exposure of results. Contingent on the availability of human and financial resources, the Bureau and project partners will aim to work with potential donors to bring the findings of this project to their attention on a country and regional scale. This will be done in the hope of further capacity development projects being undertaken based on the results of this project.



## 6. Annexure



## 6. Annexure

### 6.1. Annexure 1: Record of Participants

Organisation	Position	Title	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
National Disaster Management Office (NDMO)	P. Secretary Office of the President (OB)	Mr	Enote	Ingintau		21183			eingintau@gmail.com
Kiribati Adaptation Project (KAP II)	Project Manager	Mr	Kaiarake	Taburuea	KAP II Office, Bairiki	21696		93226	ktaburuea@yahoo.com
	Project Coordinator	Mr	Kautuna	Kaitara					kkaitara@yahoo.com
Ministry of Environment, Lands and Agricultural Development (MELAD)	A/Climate Change Planning Officer	Mr	Riibeta	Abeta	MELAD, P.O. Box 234, Bikenibeu, Tarawa	28507			riibeta.ecd@melad.gov.ki
	Assistant Awareness Officer	Ms	Makin	Binataake					makin.ecd@melad.gov.ki
	Agriculture Officer	Mr	leete	Timea		28108			
Ministry of Education (CDRC)	Curriculum Development Officer	Mr	loketan	Binataake	Ministry of Education (CDRC), Bikenibeu, Tarawa	28052			ioketanb@yahoo.com
Ministry of Health and Medical Services (MHMS)	Director of Public Health	Dr	Airam	Metai	Nawerewere	28100			airam_metai@yahoo.co.nz
		Dr	Ken	Reuee				98894	rose_sanre@yahoo.com
Ministry of Finance and Economic Development (MFED)	Economist – National Economic Planning Office		Temarewe	Tekaatau	Ministry of Finance and Economic Development, Bairiki, Tarawa	21811			temteata@gmail.com econ3@mfed.gov.ki
		Ms	Faitele	Miika		21848			mfaitete@hotmail.com

Organisation	Position	Title	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
Kiribati National Council of Churches (KNCC)	General Secretary	Mr	Tebebeku	Teia	KPC Headquarters, Antebuka	21195		98617	
Marine Guard Division									
Kiribati Port Authority	Human Resource Officer	Mr	Tanua	Pine	KPA, Betio, Tarawa	26978			hrm@kpa.com.ki
Kiribati Police Services	OIC, Bikenibeu Police	Mr	Euta	Taokai	Bikenibeu	28043	28042	98643	
Kiribati Police and Fire Services (Fire Services)	OIC Fire Service	Mr	Ritiati	Kiteon		28177		98638	rkaobunang@yahoo.com.au
Ministry of Foreign Affairs	Senior Assistant Secretary	Mr	Uriam	labeta		21342			as@mfa.gov.ki
Ministry of Internal and Social Affairs (MISA)	A/Local Government Officer		Bouadaake	Tengkam	Bairiki	21092		98061	
Ministry of Internal and Social Affairs (MISA), Culture/Museum	Senior Cultural Officer, OIC	Mr	Tekautu	Ioane	Ministry of Internal and Social Affairs. P.O. Box 308, Bikenibeu, Tarawa	28283			tekautun@yahoo.com
	Cultural Officer	Mr	Natan	Itonga					natitonga@hotmail.com
Kiribati Association of Non-Governmental Organisations (KANGO)	Executive Board Member	Mr	Erietera	Mwaerere	P.O. Box 162, Bairiki, Tarawa	22820	22819		kango@tskl.net.ki
Ministry of Communications, Transport and Tourism Development (MCTTD)	P. Secretary	Mr	Kietau	Tabwebweiti		26003			secretary@mict.gov.ki
	D. Secretary	Ms	Tarsu	Murdoch					ds@mict.gov.ki
	A. Secretary	Ms	Tenenekai	Baikawa					as@mict.gov.ki
		Mr	Moote	Kaburee					marinesurveyor@mict.gov.ki

Organisation	Position	Title	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
Ministry of Communications, Transport and Tourism Development (MCTTD), Kiribati Meteorological Service (KMS)	Chief Meteorological Officer	Mr	Moreti	Tibiriano		26511			moretimaria@gmail.com
	Climate Officer	Mr	Tareti	Kireua		25444	26089		tkireua@gmail.com
	Meteorology Officer	Mr	Rition	Kabunateiti					
	Senior Met. Officer	Ms	Teera	Teetam					
	Senior Met. Officer	Mr	Iokenti	Beniamina					
	Scientific Officer	Mr	Ueneta	Toorua					uenetat@gmail.com
Ministry of Fisheries and Marine Resources Development (MFMRD), Fisheries Division	Director for Fisheries		Ribanataake	Awira	P.O. Box 64 Bairiki, Tarawa	28252	21009		
	Fisheries Officer		Tuake	Teema					
Ministry of Fisheries and Marine Resources Development (MFMRD), Minerals Division	Officer in Charge	Mrs	Reenate	Willie	MFMRD Headquarters	21099			reenatew@mfmrd.gov.ki
	Mineral Officer	Ms	Kabure	Yeeting					kaburey@mfmrd.gov.ki
Ministry of Public Works and Utilities (MPWU)	A/Director of Engineering		Moanataake	Beiabure		26192			
	Permanent Secretary		Reina	Timau					
	Water Unit		Moulongo	Ataatia					
	Water Technician	Mr	Kairoronga	Tamafolau		26142			pemeti_tamafolau@yahoo.com
Broadcasting Publication Authority	Reporter	Mr	Rikameti	Naare	BPA, P.O. Box 78, Bairiki, Tarawa	21187	21161		

Organisation	Position	Title	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
FM 89	Senior News Reporter	Ms	Beiatetaake	Burabura	New Air FM, Ambo, Tarawa	22050	22630	94825	
KPC Newspaper	Manager – Mauri newspaper	Rev	Riimeti	Bauro	KPC Headquarters, Antebuka	22182			riimetib@yahoo.com
Television Kiribati Limited	CEO	Mr	Tom	Kaitara		26036			tom@maurinet.ki
Telecommunication Authority of Kiribati		Ms	Eveata	Maata		25432			
Telecom Services Kiribati Limited (TSKL)		Mr	Naibunaki	Teraoi		20743			nteraoi@tskl.net.ki
Red Cross	Secretary-General					25501			redcross@tskl.net.ki



## 6.2. Annexure 2: The Visiting Assessment Team

Team Position	Name	Position within Organisation	Organisation	Contact Details
Natural Hazard Warning Expert and Team Leader	Ian Shepherd	Manager, Severe Weather, Northern Territory	Australian Bureau of Meteorology	<a href="mailto:I.Shepherd@bom.gov.au">I.Shepherd@bom.gov.au</a> Ph. +61 8 8920 3821 Fax. +61 8 8920 3840
Emergency Management Expert	Greg Lovell	Director Planning & Coordination Section	Emergency Management Australia	<a href="mailto:greg.lovell@ema.gov.au">greg.lovell@ema.gov.au</a> Mobile: +61 4 1729 9132
Data Communications Expert	Paul Hambleton	Data Communications Specialist	Australian Bureau of Meteorology	<a href="mailto:paul.hambleton@bom.gov.au">paul.hambleton@bom.gov.au</a> Ph. +61 3 9669 4479 Fax. +61 3 9669 4803
Regional Expert	Not applicable (SOPAC was unable to attend)			

## 6.3. Annexure 3: Agenda, Kiribati Tsunami Capacity Assessment Workshop

<b>DAY 1: Monday 8<sup>th</sup> September 2008</b>				
<b>SESSION 1: OPENING ADDRESS AND INTRODUCTORY PRESENTATIONS</b>				
<b>LOCATION: Otintai Hotel, Tarawa</b>				
<b>CHAIR: Ian Shepherd, Team Leader, Visiting Assessment Team</b>				
<b>Time</b>	<b>Item</b>	<b>Quest Ref</b>	<b>Duration</b>	<b>Participation</b>
<b>9.00 – 9.30am</b>	<ul style="list-style-type: none"> <li>• <b>Welcome Address</b></li> <li>• <i>Chair Person – Mr. Moreti Tibiriano, Director, Kiribati Meteorological Services</i></li> <li>• <i>Address by Secretary of the Ministry of communication, Transport and Tourism Development.</i></li> <li>• <i>Address by Duncan McCullough, Development Program Specialist, AusAID, Kiribati.</i></li> <li>• <i>Address by Team Leader, Visiting Assessment Team – Ian Shepherd</i></li> </ul>	<b>NA</b>	<b>0.5hrs</b>	<b>Open</b>
<b>9.30 – 10.00am</b>	<p><b>Presentation –</b></p> <ul style="list-style-type: none"> <li>• <i>Introduction to the tsunami capacity assessment project, tsunami science and the tsunami hazard in relation to Kiribati</i></li> <li>• <b>Presenter: Ian Shepherd</b></li> </ul>	<b>NA</b>	<b>0.5hrs</b>	<b>Open</b>
<b>10.00 – 11.00am</b>	<p><b>Presentation –</b></p> <ul style="list-style-type: none"> <li>• <i>Tsunami monitoring, warnings and response in Kiribati</i></li> <li>• <b>Presenter: Secretary, Office of the Beretitenti</b></li> </ul>	<b>NA</b>	<b>1hr</b>	<b>Open</b>
<b>11.00 – 11.30am</b>	<b>Opening Morning Tea</b>	<b>NA</b>	<b>0.5hrs</b>	<b>Open</b>

Time	Item	Quest Ref	Duration	Participation
<b>SESSION 2:</b>	<b>ORGANISATIONS, COMMITTEES, LEGISLATION, STRATEGY, COOPERATION, RESEARCH, MITIGATION</b>			
<b>LOCATION: Otintai Hotel, Tarawa</b>				
<b>CHAIR: Ian Shepherd, Team Leader, Visiting Assessment Team</b>				
<b>11.30 - 12.30pm</b>	<b>Focus Groups</b> <ul style="list-style-type: none"> <li><i>Kiribati's priorities for implementing an effective tsunami warning and mitigation system</i></li> </ul>	Section 4	1hr	Open
<b>12.30 – 1.30pm</b>	<b>Lunch</b>	NA	1hr	Open
<b>1.30 – 2.30pm</b>	<b>Capacity Assessment – Organisations, Committees and Legislation:</b>			
	<ul style="list-style-type: none"> <li><i>Organisations involved in tsunami warning and mitigation in Kiribati</i></li> </ul>	Section 2, Part A	1hr	Open
	<ul style="list-style-type: none"> <li><i>Tsunami warning and mitigation coordination committees at National, and village level in Kiribati</i></li> </ul>	Section 2, Part B		
	<ul style="list-style-type: none"> <li><i>Legislation relevant to tsunami warnings and emergency response</i></li> </ul>	Section 2, Part C		
<b>2.30 – 3.30pm</b>	<b>Capacity Assessment – Strategy, International and Regional Cooperation, All Hazards Approach:</b>			
	<ul style="list-style-type: none"> <li><i>Disaster risk reduction strategy in Kiribati</i></li> </ul>	Section 2, Part D	1hr	Open
	<ul style="list-style-type: none"> <li><i>International and Regional cooperation for tsunami warning and mitigation in Kiribati</i></li> </ul>	Section 2, Part E & F		
	<ul style="list-style-type: none"> <li><i>All-hazards approach</i></li> </ul>	Section 3		
<b>3.30 – 4.00pm</b>	<b>Afternoon tea</b>	NA	<b>0.5hrs</b>	<b>Open</b>
<b>4.00 – 5.00pm</b>	<b>Capacity Assessment – Research and Monitoring:</b>			
	<ul style="list-style-type: none"> <li><i>Research and development expertise</i></li> <li><i>Tsunami monitoring infrastructure (seismic network, sea-level network and utilisation of satellites for data communication)</i></li> <li><i>Case Study – Use of this monitoring infrastructure for the 15 Nov 2006 Kuril Islands Event</i></li> </ul>	Section 5 Section 6, Part A, B, C & Case Study – Monitoring Systems	1hr	Open
<b>5.00pm</b>	<b>CLOSE OF DAY</b>			

**DAY 2: Tuesday 9<sup>th</sup> September 2008****SESSION 3: TSUNAMI WARNINGS****LOCATION: Otintai Hotel, Tarawa****CHAIR: Paul Hambleton, Data Communications Expert, Visiting Assessment Team**

Time	Item	Quest Ref	Duration	Participation
9.00 – 9.30am	<b>Presentation:</b> <ul style="list-style-type: none"> <li><i>Tsunami Warnings &amp; Communication</i></li> </ul> <b>Presenters: Ian Shepherd &amp; Paul Hambleton</b>	NA	0.5hrs	Open
9.30 – 10.30am	<b>Capacity Assessment – Tsunami warning system in Kiribati:</b>			
	<ul style="list-style-type: none"> <li><i>International communication cooperation</i></li> <li><i>National tsunami warning centre</i></li> <li><i>Receipt of advisories from PTWS</i></li> </ul>	Section 7, Part A, B, C	1hr	Open
10.30 – 11.00am	<b>Morning Tea</b>	NA	0.5hrs	Open
11.00 – 12.00pm	<b>Capacity Assessment – Tsunami warning system in Kiribati <u>continued</u>:</b>			
	<ul style="list-style-type: none"> <li><i>Procedures for dissemination of tsunami warnings Nationally, once received from PTWS</i></li> <li><i>Case Study – Tsunami Advisory Messages and Warnings for the 15 Nov 2006 Kuril Islands Event</i></li> </ul>	Section 7, Part D, E, F, G, Case Study – <i>Tsunami Advisory Messages and Warnings</i>	1hr	Open
12.00 – 1.00pm	<b>Lunch</b>	NA	1hr	Open

**SESSION 4: EMERGENCY RESPONSE, MITIGATION AND PREPAREDNESS****LOCATION: Otintai Hotel, Tarawa****CHAIR: Greg Lovell, Emergency Management Expert, Visiting Assessment Team**

Time	Item	Quest Ref	Duration	Participation
1.00 – 1.30pm	<b>Presentation:</b> <ul style="list-style-type: none"> <li>• <i>Emergency Coordination and Planning</i></li> </ul> <b>Presenter: Greg Lovell</b>	NA	0.5hrs	Open
1.30 – 3.00pm	<b>Capacity Assessment - Emergency response, mitigation and preparedness:</b>			
	<ul style="list-style-type: none"> <li>• <i>Assessing the capacity of the disaster management system in Kiribati and identifying training needs</i></li> <li>• <i>Emergency response and recovery plans</i></li> <li>• <i>Evacuation (including evacuation legislation)</i></li> </ul>	Section 8, Part A, B & C	1.5hrs	Open
3.00 – 3.30pm	<b>Afternoon Tea</b>	NA	0.5hrs	Open
3.30 – 5.00pm	<b>Capacity Assessment - Emergency response, mitigation and preparedness <u>continued</u>:</b>			
	<ul style="list-style-type: none"> <li>• <i>GIS use for emergency response</i></li> <li>• <i>Testing and exercising</i></li> <li>• <i>Consideration of critical infrastructure</i></li> <li>• <i>Tsunami mitigation efforts</i></li> <li>• <i>The role of NGOs in tsunami warning and mitigation</i></li> <li>• <i>Case Study – Preparedness and response for the 15 Nov 2006 Kuril Islands Event</i></li> </ul>	Section 8, Part D, E, F, G, H & Case Study – Preparedness and Response	1.5hrs	Open
5.00pm	<b>CLOSE OF DAY</b>			

**DAY 3: Wednesday 10<sup>th</sup> September 2008****SESSION 5: TSUNAMI HAZARD, VULNERABILITY, RISK AND COMMUNITY AWARENESS****LOCATION: Otintai Hotel, Tarawa****CHAIR: Ian Shepherd, Team Leader, Visiting Assessment Team**

Time	Item	Quest Ref	Duration	Participation
<b>9.00 – 10.30am</b>	<b>Capacity Assessment – Hazard, Vulnerability, Risk:</b>			
	<ul style="list-style-type: none"> <li>• <i>Post tsunami surveys</i></li> <li>• <i>Tsunami hazard, vulnerability and numerical modelling studies</i></li> <li>• <i>Community participation in assessing the tsunami risk</i></li> </ul>	<i>Section 9, Part A, B, C, D, E, F</i>	<i>1.5hrs</i>	<i>Open</i>
<b>10.30 – 11.00am</b>	<b>Morning Tea</b>	<b>NA</b>	<b>0.5hrs</b>	<b>Open</b>
<b>11.00 – 1.00pm</b>	<b>Capacity Assessment – Public and Stakeholder Awareness and Education:</b>			
	<ul style="list-style-type: none"> <li>• <i>Assessment of public awareness</i></li> <li>• <i>The role of public awareness in understanding warnings and taking action</i></li> <li>• <i>Public awareness and education programs</i></li> <li>• <i>Media education programs</i></li> <li>• <i>Tsunami memorials and museums</i></li> </ul>	<i>Section 10, Part A, B, C, D</i>	<i>2hrs</i>	<i>Open</i>
<b>1.00 – 2.30pm</b>	<b>Lunch</b>	<b>NA</b>	<b>1.5hr</b>	<b>Open</b>

<b>SESSION 6: PRESENTATION OF PRELIMINARY ASSESSMENT FINDINGS</b>				
<b>LOCATION: Otintai Hotel, Tarawa</b>				
<b>CHAIR: Ian Shepherd, Team Leader, Visiting Assessment Team</b>				
<b>2.30 – 3.30pm</b>	<b>Presentation:</b> <ul style="list-style-type: none"> <li><i>Kiribati's strengths, challenges, preliminary recommendations and next steps</i></li> </ul> <i>Presenter: Ian Shepherd</i>	<b>NA</b>	<b>1hr</b>	<b>Open</b>
<b>3.30 – 4.00pm</b>	<b>Questions and Feedback</b>	<b>NA</b>	<b>0.5hrs</b>	<b>Open</b>
<b>4.00 – 5.00 pm</b>	<b>Workshop Closing Ceremony</b>	<b>NA</b>	<b>0.5hrs</b>	<b>Open</b>
<b>5.00pm onwards</b>	<b>Workshop Dinner</b>	<b>NA</b>	<b>NA</b>	<b>Participants and Guests of Honour</b>

## 6.4. Annexure 4: Supporting Documents Log

Ref.	Document Name	Copy Obtained (Y/N)	Format (H = Hard Copy) (E = Electronic)
D1	National Disaster Act 1993	Y	H
D2	Pacific Islands-Climate Prediction Project (PI-CPP)	Y	H
D3	World Bank-Adaptation Project –Implementation Phase (KAP II)	Y	H
D4	Kiribati newspapers	Y	H
D5	Radio Weather reports	Y	H
D6	Radio Kiribati program schedule	Y	H
D7	Valuation Tables for Temaiku & Bikeniebu	Y	E
D8	Land Development Guidelines for South Tarawa	Y	E
D9	A technical guide to Risk Identification and Risk Analysis: Towards Coastal Risk Hazard Diagnosis for Republic of Kiribati Case Study Sites	Y	E
D10	World Bank Study – Cities, Seas and Storms. Managing Change in Pacific Island Communities. Volume VI adapting to Climate Change.	Y	E
D11	Kiribati Development Plan 2008 - 2011	Y	E
D12	Local Government Act 2006	Y	H
D13	Public Health Ordinance	Y	H
D14	KIRI-EU outer communities' health clinics radio communications brochure	Y	H
D15	Broadcasting & Publications Authority	Y	H
D16	Kiribati Phone Book	Y	H
D17	PIPA - Nomination for a World Heritage site	Y	E
D18	D18_PIPA Regulations 2008	Y	E



Ref.	Document Name	Copy Obtained (Y/N)	Format (H = Hard Copy) (E = Electronic)
D19	D19_Environment (Amendment) Act 2007	Y	E
D20	Kiribati & Global Warming. Paradise Found – Phoenix Islands	Y	DVD on file 25/007080
D21	Mechanism of earthquake and tsunami. Let's Creating Islands Happiness. Both in Gilbertese & Pidgin	Y	DVD on file 25/007080
D22	ITU/ESCAP Disaster Communications Workshop, Bangkok, 2006	Y – from Internet	E
D23	National Adaptation Program of Action (NAPA)	Y – from Internet	E
D24	National Disaster Management Office (NDMO)	Y – from Internet	E
D25	<i>Preliminary Study into the Tsunami Hazard faced by Southwest Pacific, Thomas et al. 2007</i>	Y	E
D26	Inventory of Geospatial Data and Options for Tsunami Inundation & Risk Modelling KIRIBATI	Y	E
D27	A Probabilistic Tsunami Hazard Assessment of the Southwest Pacific Nations	Y	E

## 6.5. Annexure 5: Definitions

### Used in reports for SOPAC Member Countries National Capacity Assessment: Tsunami Warning and Mitigation Systems

Source: United Nations, International Strategy for Disaster Reduction, 2009

#### Capacity

A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster.

Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacity may also be described as capability.

#### Capacity building

Efforts aimed to develop human skills or societal infrastructures within a community or organization needed to reduce the level of risk.

In extended understanding, capacity building also includes development of institutional, financial, political and other resources, such as technology at different levels and sectors of the society.

#### Disaster

A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

#### Disaster risk management

The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards.

## **Disaster risk reduction (disaster reduction)**

The reduction of disaster risks and adverse impacts of natural hazards, through systematic efforts to analyse and manage the causes of disasters, including through avoidance of hazards, reduced social and economic vulnerability to hazards, and improved preparedness for adverse events

### **Early warning**

The provision of timely and effective information, through identified institutions, that allow individuals exposed to a hazard, to take action to avoid or reduce their risk and prepare for effective response.

Early warning systems include of three primary elements: (i) forecasting of impending events; (ii) processing and dissemination of warnings to political authorities and population; and (iii) undertaking appropriate and timely actions.

### **Emergency management**

The organization and management of resources and responsibilities for dealing with all aspects of emergencies, in particularly preparedness, response and rehabilitation.

Emergency management involves plans, structures and arrangements established to engage the normal endeavours of government, voluntary and private agencies in a comprehensive and coordinated way to respond to the whole spectrum of emergency needs. This is also known as disaster management.

### **Geographic information systems (GIS)**

Analysis that combine relational databases with spatial interpretation and outputs often in form of maps. A more elaborate definition is that of computer programmes for capturing, storing, checking, integrating, analysing and displaying data about the earth that is spatially referenced.

Geographical information systems are increasingly being utilised for hazard and vulnerability mapping and analysis, as well as for the application of disaster risk management measures.

### **Hazard**

A potentially damaging physical event, phenomenon and/or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological and biological) and/or induced by human processes (environmental degradation and technological hazards). *Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity, frequency and probability.*

## Land-use planning

Branch of physical and socio-economic planning that determines the means and assesses the values or limitations of various options in which land is to be utilized, with the corresponding effects on different segments of the population or interests of a community taken into account in resulting decisions.

Land-use planning involves studies and mapping, analysis of environmental and hazard data, formulation of alternative land-use decisions and design of a long-range plan for different geographical and administrative scales.

Land-use planning can help to mitigate disasters and reduce risks by discouraging high-density settlements and construction of key installations in hazard-prone areas, control of population density and expansion, and in the siting of service routes for transport, power, water, sewage and other critical facilities.

## Mitigation

Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

## Natural hazards

Natural processes or phenomena occurring in the biosphere that may constitute a damaging event.

Natural hazards can be classified by origin namely: geological, hydrometeorological or biological. Hazardous events can vary in magnitude or intensity, frequency, duration, area of extent, speed of onset, spatial dispersion and temporal spacing.

## Preparedness

Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary removal of people and property from a threatened location.

## Prevention

Activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters.

*Depending on social and technical feasibility and cost/benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters. In the context of public awareness and education, related to disaster risk reduction changing attitudes and behaviour contribute to promoting a "culture of prevention".*

## Public awareness

The processes of informing the general population, increasing levels of consciousness about risks and how people can act to reduce their exposure to hazards. This is particularly important for public officials in fulfilling their responsibilities to save lives and property in the event of a disaster.

Public awareness activities support changes in behaviour leading towards a culture of prevention. This involves public information, dissemination, education, radio or television broadcasts and the use of printed media, as well as, the establishment of information centres and networks *and community and participation actions*.

## Recovery

Decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk.

Recovery (rehabilitation and reconstruction) affords an opportunity to develop and apply disaster risk reduction measures.

## Relief / response

The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration.

## Resilience / resilient

The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.

## Risk

The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions.

Conventionally risk is expressed by the notation

Risk = Hazards x Vulnerability

Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability.

Beyond expressing a possibility of physical harm, it is crucial to recognize that risks are inherent or can be created or exist within social systems. It is important to consider the social contexts in which risks occur and that people therefore do not necessarily share the same perceptions of risk and their underlying causes.

### **Risk assessment/analysis**

A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.

The process of conducting a risk assessment is based on a review of both the technical features of hazards such as their location, intensity, frequency and probability; and also the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure, while taking particular account of the coping capabilities pertinent to the risk scenarios.

### **Structural / non-structural measures**

Structural measures refer to any physical construction to reduce or avoid possible impacts of hazards, which include engineering measures and construction of hazard-resistant and protective structures and infrastructure.

Non-structural measures refer to policies, awareness, knowledge development, public commitment, and methods and operating practices, including participatory mechanisms and the provision of information, which can reduce risk and related impacts.

### **Vulnerability**

A set of conditions and processes resulting from physical, social, economic, and environmental factors, which increase the susceptibility of a community to the impact of hazards.

## 6.6. Annexure 6: References

Australian Agency for International Development (AusAID) and Australian Bureau of Meteorology 2006, *Schedule 5 to the Record of Understanding 14304 in relation to cooperation between the Australian Bureau of Meteorology and AusAID for SOPAC Member Countries National Capacity Assessment: Tsunami Warning and Mitigation Systems*, AusAID, Canberra.

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Warne, J., 2008, *Summary - Tsunami Threat Source for Kiribati*, Australian Government Bureau of Meteorology.







## 7. CD Attachment



## 7. CD Attachment - Supporting Documents

- a. Assessment Questionnaire
- b. Supporting Documents
- c. Presentations

