

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

**Republic of the Fiji Islands**



Republic of the Fiji Islands



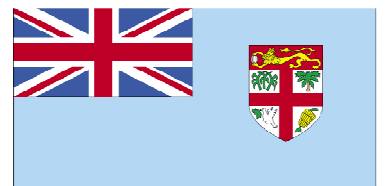
**SOPAC**





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

**REPUBLIC OF THE FIJI ISLANDS**  
**Suva, 11 – 14 March 2008**





## Document Control

<b>Approved for release:</b>	Branch Head, Weather Services Branch, Australian Bureau of Meteorology	Date: 24 June 2009
<b>Corrections &amp; comments:</b>	Cherie O'Brien Project Manager - SOPAC Member Countries Tsunami Capacity Assessments Australian Bureau of Meteorology GPO Box 1289 Melbourne VIC 3001 E-mail: c.o'brien@bom.gov.au Phone: +61 (3) 9669 4065 Fax: +61 (3) 9669 4695	
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Bureau of Meteorology (ABN 92 637 533 532)  
700 Collins St Melbourne  
Phone 03 9669 4000 • Fax 03 9669 4695

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## Acronyms

AGD	Australian Attorney-General's Department
AM	Amplitude Modulated
ATWS	Australian Tsunami Warning System
AusAID	Australian Agency for International Development
Bureau	Australian Bureau of Meteorology Bureau
D	Document (e.g. Document 39 = D39)
DEOC	District Emergency Operations Centre
DFAT	Australian Department of Foreign Affairs and Trade
DivEOC	Divisional Emergency Operation Centre
EMA	Emergency Management Australia
EMWIN	Emergency Managers Weather Information Network
EU	European Union
FIDMA	Fiji Islands Disaster Management Authority (currently known as NDMO)
FIMSA	Fiji Islands Maritime Safety Administration
FM	Frequency Modulated
FMS	Fiji Meteorological Service
GA	Geoscience Australia
GIS	Geographic Information Systems
GPRS	General Packet Radio Services
GTS	Global Telecommunications System
HF	High Frequency
ICG	Intergovernmental Coordination Group
IISEE	International Institute of Seismology and Earthquake Engineering
IOC	Intergovernmental Oceanographic Commission
ISDR	International Strategy for Disaster Reduction
ITC	Information Technology Centre
ITIC	International Tsunami Information Centre
ITSU	ICG for the Tsunami Warning System in the Pacific
JICA	Japan International Cooperation Agency
LiDAR	Light Detection and Ranging
MoU	Memorandum of Understanding
MRD	Fiji Mineral Resources Department
MSG	Melanesian Spearhead Group
Mw	Moment Magnitude
NDC	National Disaster Controller
NDMC	National Disaster Management Council (referred to as National Disaster Risk Management Council (NDRMC) in draft 2006 Fiji National Disaster Risk Management Arrangements)
NDMO	Fiji National Disaster Management Office (Referred to as Fiji Islands Disaster Management Authority (FIDMA) in draft 2006 Fiji National Disaster Risk Management Arrangements)
NDMP	National Disaster Management Plan
NDRMA	National Disaster Risk Management Arrangements
NEOC	National Emergency Operations Centre
NFA	National Fire Authority
NGOs	Non-Government Organisations
NOAA	National Oceanic and Atmospheric Administration
PDC	Pacific Disaster Centre
PGSP	Pacific Governance Support Programme
PICs	Pacific Island Countries
PTWC	Pacific Tsunami Warning Centre



## Acronyms (Continued)

PTWS	Pacific Tsunami Warning and Mitigation System
RANET	Radio and Internet for the Communication of Hydro-Meteorological Information for Rural Development
RFMF	Royal Fiji Military Forces
SERMP	Suva Earthquake Risk Management Scenario Pilot Project
SMS	Short Message Service
SOPAC	Pacific Islands Applied Geoscience Commission
SOPs	Standard Operating Procedures
SPSLCMP	South Pacific Sea Level and Climate Monitoring Project
TFL	Telecom Fiji Limited
TWG	Tsunami Working Group
UN	United Nations
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
USA	United States of America
UTC	Coordinated Universal Time
VHF	Very High Frequency
VSAT	Very Small Aperture Terminal
WMO	World Meteorological Organisation





Section

1

## 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 the Fiji Islands (hereafter referred to as “Fiji” or “Fiji Islands”) to receive, communicate and effectively respond to tsunami warnings took place in a workshop held from 11 – 14 March 2008 in Suva, Fiji.

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

As well as outlining Fiji’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 improvements in Fiji’s tsunami warning and mitigation system.

In 1953, a tsunami, generated by a coral reef platform collapse as a result of a magnitude 6.8 earthquake offshore from Suva, Viti Levu in Fiji, killed five people. In Fiji, local tsunami can be generated by submarine landslides caused by earthquakes within the Fiji Platform. In addition, Fiji is susceptible to tsunami regionally generated from the New Hebrides and Tonga subduction trenches (Refer to Figure 2) and distant sources from the surrounding so called “Pacific Ring of Fire” such as the subduction trenches off the coast of South America. Fiji’s national response to the Tonga Trench tsunami (May 2006) and the Solomon Islands tsunami (April 2007) were reviewed during the workshop to enable the visiting assessment team gain an understanding of how Fiji’s operational system..

Participants in the workshop stated a number of urgent priority areas that need to be addressed. Recurring themes included improved agency coordination and clarity of roles as well as 24/7 operation of key warning and response agencies. The workshop’s resulting recommendations reflected the priorities raised by workshop participants. High priority recommendations made include:

- Review, approval and implementation of the revised disaster management legislation, risk management arrangements and tsunami response arrangements;
- The production, by each key agency involved in tsunami warning and response, of a set of Standard Operating Procedures (SOPs);
- Continued engagement in international tsunami forums; and
- Defining responsibilities and boosting cooperation between key agencies to ensure robust 24/7 warning and response for tsunami.

To ensure timely and effective tsunami warnings for the Fiji community it is essential that tsunami warning procedures are agreed upon and implemented. Central to these procedures is outlining how the international Pacific Tsunami Warning Centre (PTWC) tsunami message will be interpreted and disseminated nationally for Fiji. The visiting team and workshop participants came to the conclusion that currently in Fiji, the realisation of effective tsunami early warning communication to the community is impeded by a lack of defined and agreed agency roles and

responsibilities. It is evident that although the Fiji Mineral Resources Department (MRD) Seismology Section is officially responsible for issuing Fiji's national tsunami warnings, it does not operate 24/7 nor can it realistically fill the required role with current resources. It was however noted that the Fiji Meteorological Service (FMS) operates 24/7, has established international and national communications links and warning dissemination mechanisms.

In view that there is currently one single qualified seismologist at the MRD Seismology Section, a large increase in ongoing expert staffing and other resources is required to support 24/7 warning operations. It is recommended that institutional arrangements are developed that allow technical agencies involved in early warning systems and disaster risk management to be located together. This would streamline operations by enabling pooling and sharing of resources, information and knowledge. This would particularly benefit sharing of information technology and communication systems. The feasibility of FMS staff (who have strong science backgrounds) being trained to assume the role of analysing and interpreting tsunami messages and data and issuing tsunami warnings should be further explored as a possible measure.

FMS and MRD Seismology Section have an existing capability and expertise that can be further built upon to move the tsunami agenda forward in Fiji. The MRD Seismology Section is undertaking commendable initiatives in tsunami preparedness such as the coastal community awareness program as well as scientific studies and training. Fiji's emergency response capability is led by the Fiji National Disaster Management Office (NDMO) and supported by a combination of Government agencies, NGOs, the private sector and regional and international organisations. Fiji also has established relationships with overseas technical agencies and foreign aid agencies that can assist in areas such as seismic and sea level monitoring equipment. To realise the required improvements strengthening of inter-agency communication and existing national forums such as the Fiji Tsunami Working Group (TWG) is required.

Fiji 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 on Fiji's tsunami warning and mitigation system. It is hoped that this could be achieved by using the National Tsunami Capacity Assessment report as the basis of a work plan for the strengthened Fiji TWG. In turn, this will assist in improving systems for other natural hazards such as earthquakes and cyclones.

Contingent on the availability of human and financial resources, the Australian Bureau of Meteorology (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 recommendations made to improve Fiji’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 Fiji’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 Fiji’s tsunami warning and mitigation system.**

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	Investigate options and formalise arrangements with Telecom Fiji, Digicel, Vodaphone and the Fiji Government to allow Short Message Service (SMS) messaging and a siren system to be used as mechanisms for warning the Fiji population.	Low (SMS) Medium (Siren)	Communications	Multi-hazard	25
Very High	Develop institutional arrangements that allow technical agencies involved in early warning systems and disaster risk management to be located together. This would streamline operations by enabling pooling and sharing of resources, information and knowledge. This would particularly benefit sharing of information technology and communication systems.	Medium	Governance and Coordination	Multi-hazard	1
Very High	That MRD Seismology Unit are adequately resourced to maintain adequately trained staff and systems (High Frequency (HF) radio, fax etc.) to enable a 24/7 (stand-by) operation for the interpretation of PTWC tsunami warning messages for Fiji and coordination with FMS for dissemination of national warnings through FMS communications channels and processes.	Medium	Governance and Coordination	Multi-hazard	2
Very High	Complete the review, approval and implementation of the revised National Disaster Management legislation for Fiji to clearly outline responsibility and authority for mitigation, preparedness (including effective early warnings), response and rehabilitation. Review other relevant Fiji legislation to ensure it compliments the National Disaster Management Act and make necessary amendments where required.	Medium	Governance and Coordination	Multi-hazard	4



Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	Complete the review, approval and implementation of the revised Fiji National Disaster Risk Management Arrangements (D17) and commence development of disaster risk management structures and plans at Divisional and District levels.	Medium	Governance and Coordination	Multi-hazard	5
Very High	Complete tsunami warning and response procedures outlining how the international PTWC tsunami message will be interpreted and disseminated nationally for Fiji with the aim of improving and finalising the draft Fiji Tsunami Warning System and Response Arrangements (D4a). Completion of this task should be a coordinated effort involving all key warning and response agencies. Upon agreement of these procedures, each agency involved must ensure they have in place a comprehensive set of SOPs to cover the responsibility of their agency.	Medium	Governance and Coordination	Tsunami specific	6
Very High	Fiji install a second back-up system at a second 24/7 operational centre to ensure redundancy in receipt of PTWC messages. It is recommended that this be in the form of additional Emergency Managers Weather Information Network (EMWIN) systems (Satellite or Internet) at a second 24/7 centre.	Medium	Tsunami Warnings	Multi-hazard	14
Very High	Use the tsunami hazard studies that have been completed for the Southwest Pacific Nations (D13, D19) to date and any historical tsunami records, to identify at low-lying communities which may be potentially prone to tsunami impacts and commence tsunami mitigation, response and evacuation planning using local knowledge.	Medium	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	30

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	Use the available inundation modelling for the Suva area (Suva hazard map) to assess and quantify likely impacts and continue to progress planning.	Medium	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	31
Very High	<p>Build on the tsunami community awareness program developed by the MRD Seismology Section with the aim of establishing a comprehensive national tsunami public education and awareness program reaching all sectors of the Fiji community. This program should be based on the knowledge of which communities are at risk where possible and fed into a multi-hazard, agency coordinated approach. Including:</p> <ul style="list-style-type: none"> <li>a. Focus on key “Tsunami Safety Rule” messages outlined in MRD Seismology Section print material (MRD Information Note 5)</li> <li>b. Separate Tsunami Safety Rules into two categories (1) Be prepared for a tsunami – with messages such as plan a tsunami evacuation route in your village and (2) Take action in the case of a tsunami – with messages such as stay out of dangerous areas until the all clear is given by the authority.</li> <li>c. Enhancement of key messages to explain the different scale of tsunami with words such as “even a small tsunami that does not wash onto land could cause danger to swimmers and damage to marine vessels”.</li> <li>d. Incorporate evaluation into programs to review the effectiveness of the program. For example, what worked, what did not, and where resources and funds should be focused.</li> </ul>	High	Public and Stakeholder Awareness and Education	Tsunami specific	38

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	<p><i>(Continued)</i></p> <ul style="list-style-type: none"> <li>e. Identify dialect / language groups that may require tailored programs.</li> <li>f. Identify other community / business sectors that may require tailored programs (e.g. tourism and hotels).</li> <li>g. Continue the use and development of the suite of materials for public education, utilising existing national and international materials wherever possible.</li> <li>h. Consider the use of electronic media for delivery of educational messages (e.g. TV and Radio).</li> <li>i. Network with regional / international agencies, such as the International Tsunami Information Centre (ITIC) regarding funds and materials.</li> <li>j. Incorporate delivery of tsunami awareness activities into annual work plans and budget proposals.</li> </ul>	High	Public and Stakeholder Awareness and Education	Tsunami specific	38
Very High	Investigate and implement (in a multi-hazard framework) an improved mechanism for dissemination of tsunami warnings to the population outside of waking hours, particularly remote villages. For example, a combination of SMS, tsunami sirens, dedicated HF radio (email enabled) or Very High Frequency (VHF) radio frequencies, Very Small Aperture Terminal (VSAT) etc.	High	Communications	Tsunami specific	24
Very High	Ensure NDMO has the resources it needs to fulfill the agencies responsibilities under the National Disaster Management Act and Plan. This should include ongoing refurbishment of operations centre and implementation of a 24/7 Duty Officer arrangement.	High	Tsunami emergency Response (including evacuation)	Multi-hazard	29

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	<p>Ensure staff are adequately trained including:</p> <ul style="list-style-type: none"> <li><b>a.</b> Completing training needs analysis of staff tsunami knowledge and skills in key warning agencies (MRD Seismology Section and FMS) and response agencies (NDMO, Police etc.). Based on this needs analysis, develop a competency based training program to address the identified training gaps of each agency.</li> <li><b>b.</b> Possible topics identified throughout this process, in which relevant agencies may require further training, include:               <ul style="list-style-type: none"> <li>○ Tsunami warning decision processes;</li> <li>○ SOPs;</li> <li>○ Model scenario interpretation;</li> <li>○ Sea level data analysis;</li> <li>○ Tsunami science and behaviour;</li> <li>○ Communication systems;</li> <li>○ Information management and networking; and</li> <li>○ Exercise management.</li> </ul> </li> <li><b>c.</b> Development of ongoing staff training (including developing links with tertiary institutions and international technical agencies) and incentive programs to ensure maintenance of adequate technical staff in Fiji.</li> </ul>	Very High	Tsunami warnings	Tsunami specific	17

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
High	Share the findings of this report with international and regional organisations (those based in Fiji and others) to provide guidance on targeting future capacity development programs and projects and use the report to guide the work of the Fiji national TWG.	Low	Regional and International Cooperation	Multi-hazard	8
High	Ensure that project agreements with international donors for upgrade of equipment includes sharing of data internationally in real-time and suitable data formats (such as Seedlink, a seismic data exchange protocol) to facilitate improvements in accuracy of messages from international tsunami watch/warning providers.	Low	Tsunami Monitoring Infrastructure	Tsunami specific	11
High	Include action prompts (pre agreed between relevant agencies) in tsunami warnings advising the community on action to take pre, during and post the tsunami event.	Low	Public and Stakeholder Awareness and Education	Tsunami specific	41
High	Continue active participation in the Southwest Pacific Tsunami Working Group (WG5) of the Intergovernmental Coordination Group (ICG) PTWS.	Medium	Regional and International Cooperation	Tsunami specific	7
High	Due to the short time period available for tsunami warning, implement an interim measure whereby FMS issues a "Tsunami Watch" bulletin based on PTWC messages on behalf of MRD, before MRD Seismology Section comes online to qualify the threat.	Medium	Tsunami Warnings	Tsunami specific	13
High	Ensure key agencies (FMS, MRD and NDMO) have updated Iridium satellite phones with international and national voice and SMS backup capability.	Medium	Communications	Multi-hazard	21

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
High	Incorporate tsunami into a multi-hazard media education program to assist the media to understand hazards and associated warnings and procedures, therefore passing the correct information onto the Fiji community.	Medium	Public and Stakeholder Awareness and Education	Tsunami specific	39
High	Develop a plan for tsunami education to occur regularly post a tsunami event. This is particularly important if a warning was issued and a small tsunami was generated that created unusual rips and currents. It is important to educate the public that it was not a false alarm to maintain confidence the tsunami warning system.	Medium	Public and Stakeholder Awareness and Education	Tsunami specific	40
High	In possible cooperation with Fiji Live or ITC (Information Technology Centre) FMS/NDMO/MRD Seismology Section should consider running an integrated messaging system that manages SMS, e-mail, fax and voice messaging that could be the database for all emergency contacts (including satellite phones), with the possibility of expanding this system to allow for public subscription. This system should maintain the details of active staff at all agencies their roles and operational status and be accessed by the web.	High	Communications	Multi-hazard	20
High	Continue to prepare evacuation plans for villages, major urban centres and across sectors that may have special requirements (such as tourism) and incorporate these plans into the Fiji Tsunami Warning System and Response Arrangements as well as associated agency SOPs.	High	Tsunami emergency Response (including evacuation)	Tsunami specific	28

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
High	Acquire the necessary baseline data for other urban areas as part of a multi-hazard mapping activity. This will include acquiring high resolution topography (Light Detection and Ranging (LiDAR)) data of low-lying major urban areas (such as Nadi and Lautoka) as well as high resolution bathymetry data (for Nadi Bay and Lautoka area) to assist multi-hazard assessments, modelling and mapping (e.g. storm surge, climate change and tsunami). Current data available in Fiji is outlined in the report "Inventory of Geospatial Data and Options for Tsunami Inundation & Risk Modelling, Fiji Islands" (D11).	Very High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Multi-hazard	34
High	Investigate future, long-term options for completing tsunami inundation modelling, particularly for large population and infrastructure centres. Ensure consideration is given to software, hardware and the information technology capacity to analyse, interpret and use this information in operations.	Very High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	36
Medium	That NDMO, the assigned responsible agency, schedule, formal meetings of the TWG and develop a Work Plan for this working group to improve interagency coordination and integration for tsunami. Ensure nomination to the TWG of an officer from each key agency involved in tsunami warning, mitigation and response in Fiji. This group should also be used for post tsunami real event and testing debriefing to capture lessons learnt and update plans and SOPs ensuring continuous improvement (from a warning, response and recovery perspective).	Low	Governance and Coordination	Tsunami specific	3
Medium	Continue to develop and foster links with international partners with the aim of encouraging scientific research in Fiji and training opportunities for Fiji staff. Develop a protocol to receive copies of all scientific research reports completed.	Low	Research Expertise	Multi-hazard	9

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Medium	Sign Australian Tsunami Warning System (ATWS)/ South Pacific Sea Level and Climate Monitoring Project (SPSLCMP) Memorandum of Understanding (MoU) to facilitate potential upgrade, possible future installations and ongoing maintenance of tsunami and climate monitoring sea level network and potential future seismic monitoring network options by Australia.	Low	Tsunami Monitoring Infrastructure	Multi-hazard	10
Medium	The TWG, as part of SOPs, discuss, develop and implement a tsunami warning distribution list for the responsible agency to use in the case of a tsunami event. Ensure this list is agreed to by appropriate stakeholders and regularly maintained.	Low	Tsunami Warnings	Tsunami specific	16
Medium	Incorporate into Fiji's tsunami warning procedures the issuing of tsunami warnings in Fijian, Hindi and English to cater for Fiji's community.	Low	Tsunami Warnings	Tsunami specific	19
Medium	<p>Include in tsunami warning processes, issuing of "No threat" messages to the public and media for the following events:</p> <ul style="list-style-type: none"> <li>a. Felt earthquakes that are not large enough to generate tsunami;</li> <li>b. Tsunami that do not have the potential to threaten Fiji; and</li> <li>c. Under-sea earthquakes that do not have the required characteristics to generate a tsunami.</li> </ul> <p>This will prevent misinterpretation of information for sources external to Fiji, as well as maintaining practiced operational systems and community awareness when there is a long time between events.</p>	Medium	Tsunami Warnings	Tsunami specific	15



Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Medium	Work towards development of an information management system/database that enables various hazard and vulnerability data to be turned into a decision making tool for relevant Government departments. Incorporate available Global Telecommunications System (GIS) data into this database and continue capacity building in GIS use in-country.	Medium	Tsunami Hazard, Vulnerability, Risk and Mitigation	Multi-hazard	37
Medium	As part of SOPs, develop multi-agency and agency specific procedures to handle media and public enquiries and ensure accurate and timely information flow to the media and public during the warning, response and recovery stages of an operational tsunami event. These procedures could include, pre-recorded or text to voice phone warnings, designated spokespeople and topics, talking points, media release templates etc. Incorporate these arrangements into the draft Fiji Tsunami Warning System and Response Arrangements.	Medium	Tsunami Warnings	Multi-hazard	18
Medium	FMS utilise Cellular General Packet Radio Services (GPRS) for telemetry and also as a potential communications mechanism between its regional offices that have coverage.	Medium	Communications	Multi-hazard	23
Medium	Exercise the tsunami warning system and response procedures by conducting regular multi-agency exercises to facilitate coordination across Government and expose gaps and shortcomings. Exercises should include post exercise debriefs to ensure continuous improvement. It is preferable that exercises are conducted on an annual basis (at least at the strategic level) with full deployment exercises conducted every second year at all levels (National, Divisional, and District) to test the tsunami warning system and response arrangements.	Medium	Tsunami emergency Response (including evacuation)	Tsunami specific	27

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Medium	Partner with regional or international organisations to conduct paleo-seismic and paleo-tsunami studies to extend and enhance historical event records.	Medium	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	35
Medium	Continue implementation of risk reduction recommendations from the Suva Earthquake Risk Management Scenario Pilot Project (SERMP, D19, 2002) and consider extension to other urban areas.	High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	32
Medium	FMS and other agencies activate their HF e-mail system. This is vital for during disasters when other communication mechanisms may fail.	High (Funding required)	Communications	Multi-hazard	23
Medium	FMS investigate access to Pacific sea-level data for tsunami warnings via the Global Telecommunications System (GTS) with the Bureau including agreement on the Bureau communicating to FMS when instrumentation is out of order.	Medium	Tsunami Monitoring Infrastructure	Tsunami specific	12
High	<p>Complete an inventory of agency and national communication systems and investigate options for integration. Possibilities include:</p> <ul style="list-style-type: none"> <li>a. Investigating extending the use of the FMS direct line to Honolulu National Weather Service to PTWC for tsunami warning purposes; and</li> <li>b. FMS assisting NDMO to set up and maintain their EMWIN system by training NDMO staff.</li> </ul>	Medium	Communications	Multi-hazard	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 Intergovernmental Oceanographic Commission (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 Pacific Island Countries (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://ioc3.unesco.org/indotsunami/nationalassessments.htm>

## 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 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 Pacific Tsunami Warning and Mitigation System (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 products 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 ICG for the 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, 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 Fiji

Fiji's 1.3 million square kilometre Exclusive Economic Zone in the South Pacific Ocean contains approximately 330 islands, of which about one third are inhabited. Fiji, with a total land area is 18,333 square kilometres, has two major islands, Viti Levu (10,429 square kilometres) and Vanua Levu (5,556 square kilometres). The Capital, Suva, is the most populated city with 167,975 persons followed by Lautoka with 43,274 and Nadi at 30,884. The official language of Fiji is English (University of the South Pacific, 2009).

The estimated population of Fiji in 2007 was 869,000 people. The population is made up of a combination of indigenous Fijians (50%), Indians (46%), with the remainder of the population including Rotumans, Chinese, other Pacific Islanders and Europeans (University of the South Pacific, 2009). Fiji is becoming increasingly urbanised as internal migration to towns and cities continues. Close to half of Fiji's population now live in urban areas (Fiji Government Online, 2009).

Fiji's economy is based on mainly agriculture and tourism. The sugar and tourism industries provide employment for over 50% of the labour force, with that figure looking to increase due to the influx of resorts and hotels being built in the West. Both sugar and tourism are based mainly in Western Viti Levu. A variety of crops are also produced including coconut oil, cocoa, ginger and kava. Fiji's tourism industry has grown over the last decade to become an important source of jobs and the major source of foreign exchange since 1990 (Fiji Government Online, 2009).

On independence in 1970, Fiji adopted a constitutional democratic form of government based on the Westminster model. Fiji has a bicameral parliament consisting of a nominated Senate, an elected House of Representatives and a Cabinet presided over by a Prime Minister. Fiji is a member of the United Nations (UN), the Commonwealth, the Pacific Community, and the Pacific Islands Forum. It also has trade and political links with Papua New Guinea, Solomon Islands and Vanuatu through the Melanesian Spearhead Group (MSG), and is a member of the African-Caribbean-Pacific Group associated with the European Union (EU) (DFAT, 2009). Because of its central location in the South Pacific and relatively well-developed economy and infrastructure, Fiji is also host to many regional and international organisations.

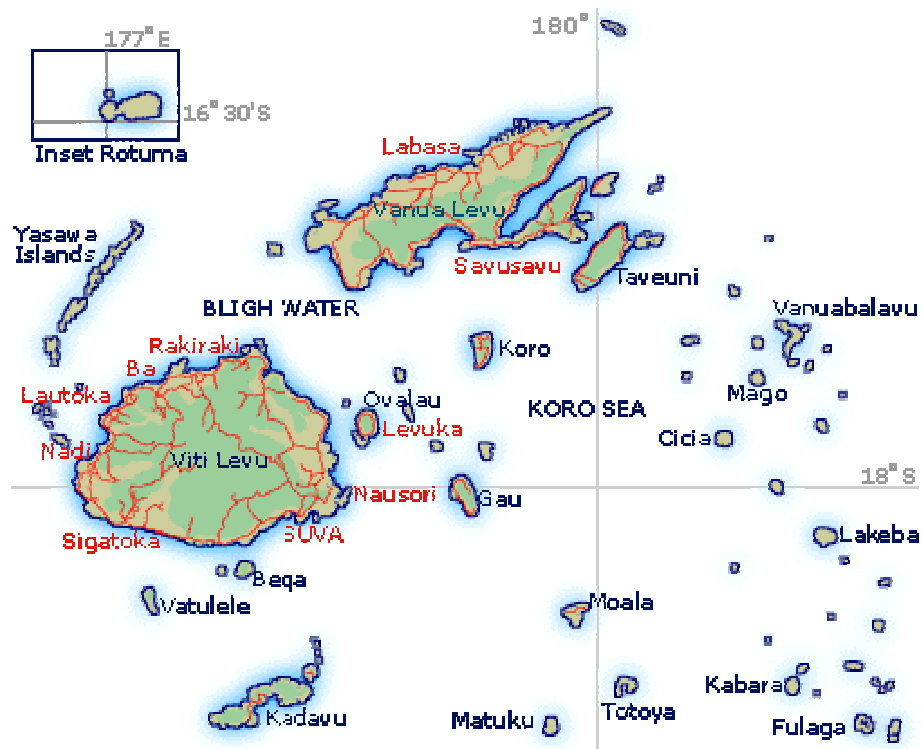


Figure 1: The Fiji Islands (Source: <http://www.fiji.gov.fj>)

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

An overview of potential tsunami threat sources and tsunami history in Fiji is outlined below. This information should be treated as general background and does not attempt to provide a comprehensive picture of tsunami hazard and vulnerability and associated risk for Fiji. Such a study is outside the scope of this project.

Reliable recording of seismic events in Fiji commenced in 1918 (Pacific Disaster Centre, 2005). Earthquakes occur in several zones, with some of the largest earthquakes in Fiji occurring in the north-eastern region of the country. This region is considered to be the Islands' most active earthquake zone (Vuetibau, 2004, D4a). The main islands of Fiji, Viti Levu and Vanua Levu, are within a seismically active area within the Fiji Platform (Rahiman, 2006). This, and the seismicity of the plate boundary zone between the Pacific and Australian Plates and the Pacific Ring of Fire mean Fiji is susceptible to tsunami generated by local, regional and distant (or ocean wide) events (from sources 100 km, 1000 km, >1000 km respectively). The impact of tsunami on Fiji is variable and dependant on the shape of the seafloor between the source and the affected area (Thomas, Burbidge and Cummings, 2007, D13).

Thomas, Burbidge and Cummings, 2007 (D13) 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. For Mw 8.5 events Fiji were placed in Category 3 (normalised amplitude of 75 – 150cm). For Mw 9.0 events, Fiji were placed in Category 5 (normalised amplitude of >250cm).

A further study completed by Thomas and Burbidge (2009, D19) attempts to answer the question “which Pacific nations might experience offshore amplitudes large enough to potential result in hazardous inundation, what are the probabilities of experiencing these amplitudes and from which subduction zones might these tsunami originate”. The report states that the Tonga trench, with some contribution from the New Hebrides trench dominates the tsunami hazard to Fiji at the 2000 year return period with maximum amplitudes 1 to 3.3 metres (Thomas and Burbidge, 2009, D19). Thomas and Burbidge state that amplitudes on the eastern islands and on the eastern coast of Vanua Levu are significantly higher than elsewhere in Fiji.

There have been several recorded incidences of tsunami events within Fiji. The Pacific Disaster Centre's (PDC) *Summary of Earthquakes and Tsunamis Affecting Fiji 1850 – 2004* states that “Fiji experienced 17 tsunami events between 1877 and 2004”. Of these, four had recorded wave heights ranging between 0.5 and 5 metres above mean sea level. Fiji's Seismology Section of the MRD states that “eleven tsunamis have been recorded in Fiji, of which three were generated within Fiji waters” (Prasad, 1991).

Most of Fiji's 300 islands are volcanic in origin and have a range of fringing and barrier reefs. Local tsunami can be generated by submarine landslides caused by earthquakes (Pearce, 2008, D11). In 1953, a magnitude 6.8 earthquake originating offshore from Suva, Viti Levu triggered a coral reef platform collapse, which in turn generated a local tsunami. The tsunami itself killed five people. Another three people died as a consequence of the earthquake. The tsunami wave heights ranged from 0.7 to 5.0 metres above mean sea level. A wave height of 4.3 metres was recorded in Nakasaleka in Kadavu. Eyewitness accounts indicate that the first wave took only 3 minutes to reach Suva (Pacific Disaster Centre, 2005 and Rahiman, 2006).

Three other significant events have been caused by earthquakes that occurred off the island of Vanua Levu in 1881 and off the coast of Chile in South America in both 1877 and 1960. During the 1960 Chile event, the tsunami waves took approximately 13 hours to reach Suva. In Fiji the tsunami damaged ships anchored at Walu Bay but fortunately, caused no deaths (Pacific Disaster Centre, 2005). A small tsunami was generated in 1975 by a moderate earthquake in Fiji's Kadavu

Passage. Once again, this local tsunami resulted from an underwater landslide (Gajendra, 1991, D8).

Investigation of the Bureau's deep ocean model-based tsunami prediction system conducted by Dr. Jane Warne (ATWS Project Network Design Manager) demonstrates that the local and regional subduction zone threat sources for the Fiji Islands are the New Hebrides and Tonga Trenches (Refer to Figure 2b). There is also limited threat from the Kermadec Trench and the South Solomon Trench (Refer to Figure 2b). Travel times for tsunami from these sources vary but are typically between 2 to 2.5 hours from the New Hebrides and Tonga Trenches and approximately 3 to 3.5 from the South Solomon and Kermadec Trenches. More remote source, such as those from Peru-Chile, USA, Canada, Japan and the Kuril Islands (Figure 2a) also pose a tsunami threat to Fiji but only for major earthquakes of at least magnitude 8.0 and above. These sources are more than 10 hours away. Adequate time for warning and evacuation would therefore exist from an efficient tsunami warning system.



Figure 2a: The subduction zones (in orange) of the Pacific Ocean



Figure 2b: The location of Fiji and other Pacific Island Countries in relation to regional and local subduction zones (in orange)







## 4. The Fiji Tsunami Capacity Assessment



## 4. The Fiji Tsunami Capacity Assessment

### 4.1. Date and Location

The Tsunami Capacity Assessment of the ability of the Fiji Islands to receive, communicate and effectively respond to tsunami warnings took place from 11 – 14 March 2008 at the Holiday Inn, Suva.

### 4.2. Visiting Assessment Team and Participants

The visiting assessment team was made up of those outlined in Annexure 2. The focal points in Fiji for the completion of this project were Mr Rajendra Prasad, Director, FMS and Mr Lasarusa Vuetibau, Senior Seismologist, MRD Seismology Section. A full list of workshop participants can be found in Annexure 1.

### 4.3. Visit to Nadi Regional Specialised Meteorological Centre

A visit to Nadi Regional Specialised Meteorological Centre, operated by FMS, was undertaken by part of the visiting assessment team prior to the commencement of the Tsunami Capacity Assessment Workshop. The visit was primarily aimed at helping the visiting assessment team gain an improved understanding of the operations and resources available at Nadi. Initial talks were held with Mr Rajendra Prasad, the Director, and then a group meeting was held with available technical and operational staff to discuss specific issues in communication systems. Outcomes of the discussion are included in Annexure 5.

### 4.4. Workshop Summary

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

#### 4.4.1. *Day 1 (5 February 2008)*

Mr. Pajillai Dobui, from the NDMO, was the Master of Ceremonies for the opening of the workshop. The opening ceremony commenced with the singing of the Fiji National Anthem and an opening prayer. Mr Rajendra Prasad, Director of FMS welcomed participants. Rick Bailey, ATWS Project Director for the Bureau, made an opening address on behalf of the visiting assessment team. A vote of thanks from the participants to the visiting assessment team was then made before the closing prayer.

After refreshments, presentations were given by Fiji representatives Mr Rajendra Prasad and Lasarusa Vuetibau. Topics included Fiji's early warning system, tsunami disaster management and risk reduction and tsunami awareness programs in Fiji. Rick Bailey then provided an overview of tsunami, tsunami systems and the national Tsunami Capacity Assessment project.

In the afternoon the workshop participants commenced discussing and recording answers to the questionnaire (refer to Attachment 1a).

**4.4.2. Day 2 (6 February 2008)**

In the morning of Day 2 Sarwan Dey, Natural Hazard Warning Expert from the visiting assessment team, presented to the workshop on the tsunami threat to Fiji and early warning systems in general. Bryan Hodge, Data Communications Expert from the visiting assessment team then presented on data communications for tsunami warnings. For the remainder of the day the workshop participants continued to discuss and record answers to the questionnaire (refer to Attachment 1a).

**4.4.3. Day 3 (7 February 2008)**

In the morning of Day 3, a presentation was made by Peter Willett, Emergency Management Expert for the visiting assessment team, on emergency management and preparedness for tsunami in the Australian context. Michael Bonte-Graptin, Risk Assessment Specialist for the visiting assessment team, then presented on work that has been completed for tsunami risk assessment in Fiji. Workshop participants continued to discuss and record answers to the questionnaire (refer to Attachment 1a). In the afternoon site visits were conducted by the visiting team, accompanied by Fiji participants. Visits were made to:

- The Fiji Meteorological Service, Laucala Bay Weather Observation Station;
- Suva Harbour Sea level Station;
- Fiji's Seismology Section, Mineral Resources Department, Nabua;
- Seismic Station; and
- The Fiji National Disaster Management Office.

**4.4.4. Day 4 (8 February 2008) (Morning only)**

A presentation of preliminary findings from the visiting assessment team was made by Rick Bailey. Fiji participants then had the opportunity to provide feedback on these preliminary findings and the project methodology in general. Closing addresses to the workshop were provided by Cherie O'Brien, Rick Bailey and Michael Bonte-Graptin from the visiting assessment team as well as the Permanent Secretary for Provincial Development, Multiethnic Affairs, and Disaster Management, Mr Manasa Vaniqi. The close of the workshop was followed by lunch and a discussion of the ATWS/SPSLCMP MoU.

#### 4.5. Workshop Photos (Suva March 2008)



Tsunami Capacity Assessment Workshop participants



Sarwan Dey presents typical tsunami travel times to Fiji



Tsunami Capacity Assessment Workshop participants



Visit to the Mineral Resources Department Seismology Section, Nabua



Tauz Khan from Safeway Electronics Ltd, demonstrates the tsunami test siren on the roof of Laucala Bay Weather Observation Station





Section

**5**

## 5. Assessment Results





## 5. Assessment Results

### 5.1. Status of Key System Components

The Tsunami Capacity Assessment Workshop results are summarised below in Table 3 in which the status of key components of the Fiji Islands tsunami warning and mitigation system are outlined (as at the date the Tsunami Capacity Assessment Workshop was held in March 2008, updates between then and the publication of this report are as marked).

**Table 3: Summary of current status of key components of the Fiji Islands tsunami warning and mitigation system as at March 2008**

**Rating**

Yes - fully realised
Partially realised
No - not realised

Key Component	Rating	Discussion
<b>Authority, Coordination and NGO Role</b>		
Legislation in place for tsunami warnings and response	<b>Partially</b>	<p>Legislative responsibility for issuing tsunami warnings is currently not formally defined. The Natural Disaster Management Act 1998 (D2) and Amendment 11/2005 makes provision for formulation and implementation of disaster management policies and structures at a national and divisional level (<b>Update March 2009</b> – Revisions of this Act have been drafted and are due to go to the Solicitor-General’s Office for vetting). The legislation refers to the National Disaster Management Plan (NDMP, currently version 1995 being revised, D16) which outlines responsibilities across government for warnings, response and recovery for natural and man made hazards. Certain agency responsibilities during disasters are covered by their own acts, such as the Police Act.</p> <p>Under the NDMP 1995 (D16) current responsibility rests with MRD Seismology Section to “provide information and advice to National Disaster Management Council (NDMC) on matters pertaining to earthquake, tsunami and landslide”. FMS are listed as being responsible for issuing cyclone warnings under the plan but no responsibility is nominated for tsunami warnings.</p> <p>The draft 2006 Fiji National Disaster Risk Management Arrangements (NDRMA, D17), the revised version of the Fiji NDMP 1995 (D16), lists tsunami as a hazard “with the potential to create emergencies or disasters in Fiji” (D17, p11). It names the agency responsible for development and regular testing of the early warning system for tsunami as MRD with support agencies FMS, Fiji Islands Disaster Management Authority (FIDMA, currently known as NDMO), Fiji Navy, Fiji Police Force, and the Fiji Islands Maritime Safety Administration (FIMSA) (D17).</p>

Key Component	Rating	Discussion
<b>Authority, Coordination and NGO Role (Continued)</b>		
<p><i>(Continued)</i> Legislation in place for tsunami warnings and response</p>	<b>Partially</b>	<p><b>Update May 2009 –</b></p> <ul style="list-style-type: none"> <li>○ Fiji is considering engaging another consultant to complete the review of the NDMP 1995 and the plans draft replacement (the 2006 Fiji National Disaster Risk Management Arrangements).</li> <li>○ A workshop was held late in 2008 to review the draft arrangements. At this meeting a possible plan restructure was discussed and the need for accountability in the complimentary Act and plan was discussed.</li> <li>○ Under the plan review, further use of FMS as a backup will be considered given their 24/7 operation.</li> </ul>
<p>Tsunami coordination committee or effort at a National and local level</p>	<b>Partially</b>	<p>The NDMC (who report to cabinet) encompasses three committees. (1) Emergency Committee (2) Preparedness Committee (3) Mitigation and Prevention Committee. The TWG was established under the NDMC in 2002 as a recommendation of the SERMP Project. Regularity and attendance at the TWG meetings requires improvement.</p> <p>All hazard Divisional Emergency Operations Centres (DivEOC) and District Emergency Operations Centres (DEOC) exist.</p> <p><b>Update May 2009 –</b> The TWG currently meet to discuss tsunami mitigation and preparedness for Suva based on the results of the SERMP Project. Plans progressing for Suva include evacuation locations, routes and signage, billboards (showing danger areas and evacuation routes) and sirens. Dissemination of warnings is also being discussed with the three telecom providers Telecom Fiji Limited (TFL), Digicel and Vodaphone.</p>
<p>Agency responsibilities clearly defined</p>	<b>Partially</b>	<p>The draft Fiji Tsunami Warning System and Response Arrangements (D4a) outline the roles and resources of key agencies. These arrangements are yet to be finalised and adopted.</p>
<p>NGOs have a defined role in tsunami warning dissemination, preparedness and awareness and emergency response</p>	<b>Yes</b>	<p>The roles of NGOs are outlined in the NDMP 1995 (D16). The main focus of NGOs is disaster relief and community awareness.</p>
<b>International and Regional Cooperation</b>		
<p>Country represented at an international and regional level to aid cooperation in tsunami warning and mitigation efforts</p>	<b>Yes</b>	<p>Fiji became a member of the IOC in 1974 and has been regularly involved ICG/PTWS and the Southwest Pacific Working Group.</p> <p><b>Update May 2009 –</b> Fiji will have one person involved in one-year training on "Tsunami Disaster Mitigation" course run by The International Institute of Seismology and Earthquake Engineering (IISSE) and Japan International Cooperation Agency (JICA).</p>

Key Component	Rating	Discussion
<b>Priorities</b>		
<p>Priorities established for implementation of tsunami warning and mitigation system at a National level</p>	<p><b>Partially</b></p>	<p>Key players in Fiji have a developed understanding of where priorities should lie to improve Fiji's National tsunami warning and mitigation system (refer to questionnaire Question 12 and D7). Documents such as D7 outline strengths and weaknesses of the current arrangements.</p> <p>Participants in the workshop were asked to outline what they thought Fiji's urgent priorities should be to enhance the country's tsunami warning and mitigation system. Agency coordination was a consistent theme throughout these discussions. Urgent priorities identified by participants included:</p> <ul style="list-style-type: none"> <li>• Legislation and relevant plans to specify agencies roles;</li> <li>• Proper SOPs for all key agencies involved;</li> <li>• Key agencies on 24/7 watch;</li> <li>• Earliest possible issuing of warning (all of Fiji) including issuing of "No Threat" messages;</li> <li>• Basic risk assessment training for key agencies;</li> <li>• Training on how to interpret and best utilise PTWC bulletins;</li> <li>• Define roles and responsibilities of agencies and communicate amongst key-agencies;</li> <li>• Each agency to know and review roles on regular basis (staff turn-over);</li> <li>• Exercises to improve coordination; and,</li> <li>• Awareness programmes to communicate roles to other agencies/public.</li> </ul>
<b>Multi-hazard Approach</b>		
<p>Tsunami warning capabilities are being established within a multi-hazard framework</p>	<p><b>Yes</b></p>	<p>The NDMP 1995 (D16) outlines disaster risk management in an all-hazards context. The NDMC and committees, NDMO, National Emergency Operations Centre (NEOC) and related agencies are all charged to deal with disasters in a multi-hazard framework, which includes tsunami.</p>
<b>Research Expertise</b>		
<p>Active research is being undertaken within the country for seismology and tsunami to strengthen the tsunami warning and mitigation system</p>	<p><b>Partially</b></p>	<p>A number of seismological studies have been undertaken by MRD Seismology Section (refer D14). A number of regional and international agencies have also undertaken scientific research including New Zealand Geological Survey, PDC, GA, SOPAC, and Canterbury University etc.</p>

Key Component	Rating	Discussion
<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>	Fiji has a VSAT Telemetry Seismograph Network with data available in real time to MRD Seismology Section who manually calculates earthquake parameters. This is fed into national warnings where possible but is not always timely. The current network is comprised of three stations. JICA project is underway to add another three (making a total of 6) stations to broadband to allow faster automated solutions in determining threat from local earthquakes. Seismic data is not available to international community in real-time but will eventually be made available via the JICA project. The JICA project also includes training of technicians to maintain the system.
Existence of sea level stations and integration of real time data from these stations into the tsunami warning process	<b>Partially</b>	Two sea level gauges exist in Fiji that are operated by Australia. (1) Lautoka – Seaframe (2) Suva – former National Oceanic and Atmospheric Administration (NOAA) gauge now run by the Bureau. Real-time data for both stations is accessible via a Registered User Website at the Bureau as well as via the WMO GTS. This data is not currently accessed by Fiji for use in their national tsunami warnings. Sea level data is utilised by PTWC in regional warnings.
Sharing of seismic and sea level data internationally to facilitate improvement of PTWC tsunami messages for the region	<b>Partially</b>	National seismic data is not currently shared internationally. Timely and free sea level data (third party sites) is shared internationally and fed into PTWC tsunami messages. There are intentions to eventually make the seismic data available internationally after the JICA upgrade is complete.
<b>Warnings</b>		
Nation receives PTWC messages	<b>Yes</b>	<p>As per the draft Fiji Tsunami Warning System and Response Arrangements (refer to D4a), FMS is presently the agency that receives PTWC messages. The information is then passed onto the MRD Seismology Section for assessment. The MRD Seismology Section assesses the information and relays the assessed information to FMS and the NDMO. FMS are operational 24/7 and receive PTWC messages via the GTS, e-mail and to the FMS Director via Radio and Internet for the Communication of Hydro-Meteorological Information for Rural Development (RANET) SMS. MRD Seismology Section, who are not operational 24/7, receive PTWC messages from FMS (by phone call) and directly from PTWC (email and RANET SMS to the Senior Seismologist). During the night / weekends FMS is first to receive the information and then passes this onto MRD Seismology Section.</p> <p><b>Update May 2009 -</b></p> <ul style="list-style-type: none"> <li>○ The Senior Seismologist has changed phones and is currently not receiving the SMS.</li> <li>○ FMS does not contact NDMO or Fiji Police Force at the moment, only MRD.</li> </ul>

Key Component	Rating	Discussion
<b>Warnings (Continued)</b>		
24/7 operational staff at warning receipt and dissemination location	<b>Partially</b>	<p>FMS receives PTWC messages and is staffed 24/7. Neither MRD Seismology Section nor NDMO, who receive the messages internally, are 24/7. They do have informal on-call arrangements. MRD Seismology Section prepares and disseminates national tsunami warnings and NDMO prepare to coordinate emergency response.</p> <p><b>Update May 2009</b> - NDMO have no current on call arrangements. They plan to move towards a Duty Officer arrangement.</p>
Disseminate national tsunami warnings as guided by a Standard Operating Procedure	<b>Partially</b>	<p>Although the Fiji Tsunami Warning System and Response Arrangements (refer to D4a) draft plan exists arrangements and detailed SOPs for the issue of national tsunami warnings in Fiji are not yet agreed and formalised. The draft arrangements state that the authority to issue warnings and implement actions resulting from natural hazards is with the National Disaster Controller (NDC). However, the draft arrangements recognise the short onset lead time of a tsunami and propose FMS should have delegated authority to issue tsunami warnings for Fiji. The draft arrangements propose that FMS will instruct the media to broadcast specific messages directly to the public as well as instructing TFL to activate tsunami warning sirens.</p> <p>Under present arrangements FMS receives messages from PTWC and contacts MRD Seismology Section (by phone and fax). MRD Seismology Section will then issue a national bulletin in English (D9, D10). If FMS is unable to contact MRD Seismology Section, FMS will contact the Fiji Police Force and other response agencies and may issue a tsunami advisory to the general public to be broadcast on national radio.</p> <p><b>Update May 2009</b> - Dissemination of warnings is also being discussed with the three telecom providers TFL, Digicel &amp; Vodaphone using Suva as a pilot.</p>
System redundancies in place for receipt of PTWC messages and dissemination of National warnings	<b>Partially</b>	<p>FMS receives PTWC messages via the GTS and e-mail in real time. Staff at MRD Seismology Section receive the PTWC messages via email and RANET SMS (as does the FMS Director) but are not 24/7. MRD Seismology Section on duty staff are not provided with a work mobile phone. Mobile phones registered for the RANET SMS alert services are private and usually pre-paid and apparently vulnerable to be disconnected from service (lack of credits, switched off, number change).</p> <p><b>Update May 2009</b> – NDMO have an EMWIN system that is not working. SOPAC operated this system during the last flood. NDMO do not have technicians to maintain operational EMWIN. FMS (who have an EMWIN) can help set up and provide technical EMWIN training.</p>

Key Component	Rating	Discussion
<b>Warnings (Continued)</b>		
<p>Redundant 24/7 method available for dissemination of warnings to community (e.g. public radio, sirens etc.)</p>	<p><b>Partially</b></p>	<p>National broadcasts through Amplitude Modulated (AM) and Frequency Modulated (FM) radio stations are the main means of dissemination of national tsunami warnings to the Fiji community during waking hours. Television is also used. All major population centres are covered by AM and FM radio. Remote communities are covered by AM. Most households have a radio. Radio stations are 24/7 in most cases but some stations may go into pre recorded modes overnight. VSAT exists in the Lau Group. Police stations in the community are 24/7 contact points for communication.</p> <p>HF and VHF) predominately voice only radio systems exist, linking key agencies including FMS, NDMO (including District Offices), Ministry of Health, Royal Fiji Military Forces (RFMF), Fiji Police Force, TFL, Power Authorities and MRD Seismology Section. Although there is no dedicated disaster frequency NDMO have two HF channels to Divisions and Districts and FMS has three meteorological channels used formally for disaster communication.</p> <p>After hours Fiji plans to use tsunami warning sirens (a project for remotely operated siren system for Suva is underway), Fiji Police Force sirens and broadcasts from mobile units, SMS National broadcasts, RFMF sirens and communication means, Navy ships alerting systems and the National Fire Authority (NFA) (if necessary) to warn the population. Harbour Master, Navy and TFL will be responsible for marine warnings. Traditional Lali drums may be used in remote communities and face to face contact by Fiji Police Force and other response agencies may be undertaken. FMS has an internet site but tsunami warnings or advisories are not currently posted.</p> <p><b>Update May 2009</b> - Tsunami siren progress – Vodaphone funding has lapsed. New funding and a revised project proposal are required.</p>
<p>Effective warning dissemination to remote communities</p>	<p><b>Partially</b></p>	<p>Communication of tsunami warning messages to remote villages in Fiji presents a particular challenge. Remote villages and islands have AM radio coverage and a radio in most households. VSAT in locations such as the Lau Group and 24/7 Police stations are also possibilities. This may facilitate dissemination of tsunami warnings to these communities in waking hours. However, further work is required to ensure communities can receive tsunami warning messages after hours through systems in remote centres such as HF and VHF radio operated by the Ministry of Health, RFMF and Police. Community education on the natural warning signs of tsunami is also vital to ensure appropriate action is taken for locally generated tsunami for which warnings are not provided or timeframes too short. Local communities know their village and are best placed to plan their response ahead of an event occurring.</p>

Key Component	Rating	Discussion
<b>Warnings (Continued)</b>		
Communications coverage of whole country that is effectively utilised for the dissemination of tsunami warning messages	<b>Partially</b>	<p>Adequate communications coverage via FM and AM radio as well as HF radio (primarily voice) systems.</p> <p>Iridium satellite phones are relatively common (Red Cross etc.) but are not normally switched on 24/7. They are used more as a communication back up. There is concern about the costs of satellite phones (for example, FSM has an old sat phone. \$3USD per minute. Pre-paid with a post pay option). A central database of numbers is not held.</p> <p>Scope for improvement by development and use of dedicated HF frequencies, HF e-mail and SMS. Communication with field officers post a disaster or emergency requires improvement.</p>
Issue of marine tsunami warnings and guidance for vessels, harbours and ports	<b>Partially</b>	<p>There is no specific marine tsunami warning product as such. However, whatever product is put out by FMS or MRD Seismology Section is broadcast hourly over marine HF coastal radio (3DP) run by TFL. Improvement in two-way communications with small boat operators required, possibly as part of the licence system.</p> <p><b>Update May 2009 –</b></p> <ul style="list-style-type: none"> <li>○ Suva Radio is now coming under FIMSA so hopefully this can provide a better service.</li> <li>○ FMS considering whether tsunami warnings should be fed into other marine warnings.</li> </ul>
<b>Emergency Response and Evacuation</b>		
Disaster preparedness and emergency response system has been reviewed and opportunities for improvement and training identified	<b>Partially</b>	<p>Tropical Cyclone Gene and exercises such as Pacific Wave 06 and the Tsunami Emergency Response Tabletop Exercise 2007 have been effective tools to identify strengths and improvements required in Fiji's disaster preparedness and emergency response system.</p> <p>However, a plan for implementing the identified improvements required is not evident. An informal approach is taken to implement the identified improvements. There is a need to further engage with local government such as Suva City Council (resources and knowledge of localities).</p>
Tsunami emergency response, evacuation and recovery plan exists (including responsible agencies)	<b>Partially</b>	<p>The NDMP 1995 (D16) details the functions of groups at national, divisional and local level. The plan includes a "Rehabilitation" section. This plan has been reviewed and will eventually be replaced by the Fiji NDRMA (current version October 2006, D17).</p> <p>Under current arrangements (D16) the NDMO and NEOC (when activated) are responsible for emergency response, with support of other agencies. All hazard DivEOC and DEOC exist. However, in some instances, these are not fully implemented. Plans are required for Districts and Divisions.</p>

Key Component	Rating	Discussion
<b>Emergency Response and Evacuation (Continued)</b>		
<p><i>(Continued)</i></p> <p>Tsunami emergency response, evacuation and recovery plan exists (including responsible agencies)</p>	<b>Partially</b>	<p>Under the revised draft (NDRMA), FIDMA (currently known as NDMO) is listed as the lead agency for tsunami disaster/emergency response with support from all agencies as directed by the NDC (D17, p41). The draft NEOC SOPs (draft 4, 2006, D3) provides for FIDMA to become operational forming the NEOC in all types of emergency or disaster operations.</p> <p><b>Update May 2009 –</b></p> <ul style="list-style-type: none"> <li>○ The NEOC SOPs have been finalised but the National Disaster Management Plan and Act need to be finalised before the SOPs are able to be effective.</li> <li>○ NDMO currently has 12 staff.</li> </ul>
<p>The designated agency for evacuation is identified and have authority by law</p>	<b>Yes</b>	<p>Authority designated to the NDMO by the NDMC. Evacuation is organised through the NEOC.</p> <p>If a Disaster is declared the NDMC officials like Fiji Police Force and RFMF can have special powers relating to the protection of life and property (including forced evacuation). NDMC arrangements at the district and local government level are in place, but not fully implemented.</p> <p>Communication with evacuation agencies to mobilise during an event requires improvement.</p>
<p>Plans have been made for safe evacuation of population centres including aspects such as maps, routes and signage</p>	<b>Partially</b>	<p>Tsunami evacuation exercises have been conducted in Suva leading to the development of some preliminary evacuation plans and routes for Suva. During the village education progressed by MRD Seismology Section, villages are encouraged to put their own tsunami evacuation plans in place. It is expected that Suva will be a pilot area for signage. Outer islands with tourist resorts are also vulnerable and no concrete plans exist for the safe evacuation or otherwise of residents.</p> <p><b>Update May 2009 -</b> Suva City Council has agreed on evacuation routes and billboards and signage to communicate these evacuation routes to the community in low lying areas of Suva. International signage will be used. NDMO is currently looking for funding.</p>
<p>Procedures are tested and exercised to improve the response through better planning and preparedness</p>	<b>Yes</b>	<p>To assist with continuous improvement of the Fiji tsunami warning and response system, three significant tsunami exercises have been conducted in Fiji between 2003 and 2008. Exercises include:</p> <ul style="list-style-type: none"> <li>• In October 2007 Tsunami Tabletop exercise;</li> <li>• Earthquake building evacuation drill in Suva September 2003 (as part of the SERMP Project); and</li> <li>• Involvement in Pacific Wave 2006.</li> </ul> <p><b>Update May 2009 –</b> Suva evacuation test will occur once signage and community awareness plans are complete.</p>
<p>Land use policies and building codes are in place to mitigate against the tsunami hazard</p>	<b>Partially</b>	<p>Critical infrastructure has been identified in the Suva area only as part of the SERMP project (D18). Legislation, building codes (under review) and zoning of land is all aimed at reducing development in tsunami danger zones and making buildings safer. Issues addressed for Suva area (with Suva City Council), but need to be addressed for all areas within the country.</p>



Key Component	Rating	Discussion
<b>Tsunami hazard, vulnerability and risk</b>		
Completion of studies to assess the tsunami hazard in the country or Region	<b>Partially</b>	Studies have been completed by MRD Seismology Section, SOPAC and the SERMP Project (D18). The SERMP project concluded that a significant risk of local tsunami does exist for the City of Suva and its harbour environs. A Suva hazard map exists. The project considered mitigation measures for both the earthquake and tsunami impacting upon the City of Suva, with the scenario event based on the real experience of the 1953 Suva earthquake and tsunami. GA has completed a preliminary tsunami hazard assessment of the Southwest Pacific as well as a probabilistic study. Both of these studies include Fiji.
Local risk assessments have been completed for at risk communities	<b>Partially</b>	Not on a country scale, but specific for Suva area Pacific cities Suva, the SERMP project.
Adequate data exists and local inundation modelling has been completed for population centres	<b>Partially</b>	Some high resolution bathymetry and topography data exists, however, some gaps exist and need to be addressed. Refer to D11, <i>Fiji Islands Inventory of Geospatial Data and Options for Tsunami Inundation &amp; Risk Modelling</i> .
<b>Public and stakeholder awareness and education</b>		
Measures have been taken to ensure the public understand and take action in the event of a tsunami warning being issued	<b>Partially</b>	Public education (such as on the MRD Seismology Section web site and brochures) has focused on educating people to respond to the natural tsunami warning signs and warnings issued by the relevant authorities.
Community level education and preparedness programs exist for tsunami	<b>Yes</b>	<p>MRD Seismology Section tsunami awareness program has been undertaken in approximately over 90 (as at <b>May 2009</b>) coastal communities so far. This program is ongoing using the limited MRD Seismology Section budget. MRD Seismology Section also have web and print education resources (D1, D4b and D8). NDMO have a disaster awareness program (Disaster Awareness Week). The Fiji Tsunami Awareness Kit has also been distributed to schools. The Navy, FIMSA (work with maritime communities) and Fiji Red Cross also contribute to awareness programs.</p> <p><b>Update May 2009 –</b></p> <ul style="list-style-type: none"> <li>○ MRD Seismology Section’s tsunami awareness program has been integrated with NDMO into an all hazards program for rural coastal communities.</li> <li>○ A more integrated approach between key agencies is now being taken to training, awareness, exercises and development of disaster plans for schools and community. Key agencies include FMS, MRD, NDMO, NFA, St John’s Ambulance, Police and the Red Cross.</li> </ul>

Key Component	Rating	Discussion
<b>Public and stakeholder awareness and education (Continued)</b>		
Training programs for the National media exist for natural hazard and tsunami	<b>Partially</b>	Key agencies closely work with the media and are now developing an understanding of the importance of getting media involved to ensure correct information is passed onto the general public. Visits with the media are undertaken before cyclone season. The main problem is that the media get information from other sources. Further explanation of workings and limitations of tsunami system required.

## 5.2. Case Study – Tonga Trench and Solomon Islands Tsunami Events

Throughout the Tsunami Capacity Assessment Questionnaire completed in Fiji, the country's response to two events was reviewed to gain an understanding of the operation of the system in a real time event. The findings of these case studies are outlined below. The two tsunami events used for the case study included:

1. Tonga Trench Event – Magnitude 7.9, 160km northeast of Nuku'alofa (Tonga), 15:26:39 Coordinated Universal Time (UTC), Wednesday 3 May 2006 (3.30am Fiji time)
2. Solomon Islands Event – Magnitude 8.1, 45km south-southeast of Gizo (Solomon Islands), 20:39:56 UTC, Sunday 1 April 2007 (Public Holiday in Fiji, 2 April, 8.40am Fiji time)

In both instances Fiji had national seismic monitoring systems in place that detected the earthquake. For the Solomon Islands Event the earthquake evaluation was not timely because the MRD Seismology Section was not 24/7 at the time. Staff came in after a call from FMS. It took about half an hour for staff to reach the office and another 10 to 12 minutes to complete the data analysis. There are no local solutions for earthquakes outside of Fiji waters. MRD Seismology Section is using the USGS solutions. Fiji Government agencies did not use any real time sea level data during these events.

For both events the PTWC messages were received within a reasonable time frame via GTS. However, in country processes led to sub-optimal warnings issued from Fiji lead organisations. This was mainly due to the fact that MRD Seismology Section is not 24/7 and a lack of clarity about agency responsibilities. The Tonga event occurred in early morning in Fiji and the Solomon Islands event occurred on a public holiday. For both events the MRD Seismology Section issued a tsunami warning for all coastal areas in the Fiji Islands group through a national media broadcast using fax dissemination (refer to D9 and D10). On both occasions, the Tsunami Capacity Assessment team was led to believe these warnings were issued within a 30 minute window. These documents are not time stamped so the timeliness of the warnings cannot be gauged.

The response of the Fiji public to both of these events was mixed. Some evacuated and some did not know what action to take. During the Tsunami Capacity Assessment workshop a participants expressed a need for more awareness to assist in appropriate response, more coordination during the evacuation phase and more exercises to test the system.

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

Based on the discussions during the workshop with in-country participants and the supporting documentation collected during the visit, the visiting team formulated the following strengths, opportunities for improvement and recommendation under key topics which they believe will progress the tsunami agenda in Fiji.

Table 4 – Strengths, opportunities for improvement and recommendations under key topics

5.3.1. Governance and Coordination	
Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> <li>• Proactive engagement by responsible agencies in areas such as education.</li> <li>• All hazard approach to disaster management.</li> <li>• Fiji has:                             <ul style="list-style-type: none"> <li>○ Natural Disaster Management Act 1998 (D2)</li> <li>○ National Disaster Management Plan 1995 (D16)</li> <li>○ National Disaster Management Council.</li> <li>○ Divisional and district disaster management councils and emergency operations centres.</li> <li>○ A TWG (were meeting regularly but currently meeting on an ad-hoc basis). <b>(Update May 2009 –</b> The TWG currently meet to discuss tsunami mitigation and preparedness for Suva based on the results of the SERMP Project).</li> <li>○ A draft Tsunami Response Plan.</li> <li>○ NDMO with 12 staff.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Fiji does not currently hold post event debriefing and review of tsunami events. <b>(Update March 2009 -</b> Recent steps have been taken by the NDMO to conduct reviews and debriefings after January 2009 floods).</li> <li>• Roles and responsibilities should be reviewed to maximise efficiency of the warning system and account realistically for available capabilities.</li> <li>• Continuity of staff engaged in relevant roles and activities is variable, leading to difficulties ensuring efficiencies and consistency. For example, the TWG is currently inefficient due to inconsistent participation and meetings not being held on a regular basis.</li> <li>• The Fiji Tsunami Warning System and Response Arrangements (D4a) are currently in draft. Some response agencies need to review their SOPs before this plan can be finalised.</li> <li>• Review of the National Disaster Management Act (D2) and NDMP (D16) (in the form of the draft Fiji NDRMA (October 2006, D17)). <b>(Update May 2009 –</b> Fiji is considering engaging a consultant to complete the review of the plan and possibly restructure it. A workshop was held late in 2008 to review the draft arrangements).</li> <li>• Disaster Plans are required for Districts and Divisions.</li> </ul>

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

1. Develop institutional arrangements that allow technical agencies involved in early warning systems and disaster risk management to be located together. This would streamline operations by enabling pooling and sharing of resources, information and knowledge. This would particularly benefit sharing of information technology and communication systems.
2. That MRD Seismology Unit are adequately resourced to maintain adequately trained staff and systems (High Frequency (HF) radio, fax etc.) to enable a 24/7 (stand-by) operation for the interpretation of PTWC tsunami warning messages for Fiji and coordination with FMS for dissemination of national warnings through FMS communications channels and processes.
3. That NDMO, the assigned responsible agency, schedule, formal meetings of the TWG and develop a Work Plan for this working group to improve interagency coordination and integration for tsunami. Ensure nomination to the TWG of an officer from each key agency involved in tsunami warning, mitigation and response in Fiji. This group should also be used for post tsunami real event and testing debriefing to capture lessons learnt and update plans and SOPs ensuring continuous improvement (from a warning, response and recovery perspective).
4. Complete the review, approval and implementation of the revised National Disaster Management legislation for Fiji to clearly outline responsibility and authority for mitigation, preparedness (including effective early warnings), response and rehabilitation. Review other relevant Fiji legislation to ensure it compliments the National Disaster Management Act (D2) and make necessary amendments where required.
5. Complete the review, approval and implementation of the revised Fiji NDRMA (D17) and commence development of disaster risk management structures and plans at Divisional and District levels.
6. Complete tsunami warning and response procedures outlining how the international PTWC tsunami message will be interpreted and disseminated nationally for Fiji with the aim of improving and finalising the draft Fiji Tsunami Warning System and Response Arrangements (D4a). Completion of this task should be a coordinated effort involving all key warning and response agencies. Upon agreement of these procedures, each agency involved must ensure they have in place a comprehensive set of SOPs to cover the responsibility of their agency.

**5.3.2. Regional and International Coordination**

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> <li>• Well connected with international and regional bodies that can assist in disaster risk management, especially with SOPAC, United Nations Development Program (UNDP) Pacific Regional Office, United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), foreign embassies, etc. located in Fiji.</li> <li>• Benefit from related international activities through participation on the Southwest Pacific Tsunami Working Group (WG5) of the ICG PTWS. Lasarus Vuetibau from MRD Seismology Section is the vice chair of this group.</li> <li>• Fiji became a member of the IOC on 9 July 1974.</li> <li>• <b>Update May 2009</b> – Fiji will have one person involved in one-year training on "Tsunami Disaster Mitigation" course run by IISEE and JICA.</li> </ul>	<ul style="list-style-type: none"> <li>• Rigorous regional post event debriefing and review and provision of feedback to ICG/PTWS and PTWC.</li> </ul>
<b>Recommendations:</b>	
<ol style="list-style-type: none"> <li>7. Continue active participation in the Southwest Pacific Tsunami Working Group (WG5) of the ICG PTWS.</li> <li>8. Share the findings of this report with international and regional organisations (those based in Fiji and others) to provide guidance on targeting future capacity development programs and projects and use the report to guide the work of the Fiji national TWG.</li> </ol>	

**5.3.3. Research Expertise**

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> <li>• Expertise and infrastructure underpinning tsunami science, warnings, emergency response and community education</li> </ul>	<ul style="list-style-type: none"> <li>• Technical agencies, such as MRD Seismology Section and FMS face the continuing problem of losing qualified technical staff to other countries.</li> </ul>
<b>Recommendations:</b>	
<ol style="list-style-type: none"> <li>9. Continue to develop and foster links with international partners with the aim of encouraging scientific research in Fiji and training opportunities for Fiji staff. Develop a protocol to receive copies of all scientific research reports completed.</li> </ol>	

**5.3.4. Tsunami Monitoring Infrastructure**

<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Data from seismic network available in real time on VHF and VSAT network for use by Fiji.</li> <li>• Sea level infrastructure exists (Lautoka and Suva tide gauges) with information available via the GTS and via the Bureau Registered User Website.</li> <li>• Upgrade and expansion of existing seismic network to broadband capability planned with JICA. Already planned with Tonga to be able to share seismic data. JICA advocate the exchange of data internationally, especially for use in tsunami warning systems. It is planned that data will eventually be shared internationally. The JICA project also includes training of technicians to maintain the system.</li> </ul>	<ul style="list-style-type: none"> <li>• Real-time access to other seismic data in the region would improve accuracy and speed of Fiji's earthquake solutions.</li> <li>• Earthquake magnitude and location solutions reached by regional tsunami watch/warning providers, such as PTWC, could be improved by making local Fiji monitored seismic information available to the international community in real-time.</li> <li>• Signing the ATWS/SPSLCMP MoU could facilitate potential upgrade, possible future installations and ongoing maintenance of tsunami and climate monitoring sea level network by Australia.</li> <li>• Ability for relevant agency(s) to access, interpret and feed real-time sea level information into Fiji tsunami warnings would greatly enhance the national system.</li> </ul>
<p><b>Recommendations:</b></p> <ol style="list-style-type: none"> <li>10. Sign ATWS/SPSLCMP MoU to facilitate potential upgrade, possible future installations and ongoing maintenance of tsunami and climate monitoring sea level network and potential future seismic monitoring network options by Australia.</li> <li>11. Ensure that project agreements with international donors for upgrade of equipment includes sharing of data internationally in real-time and suitable data formats (such as Seedlink, a seismic data exchange protocol) to facilitate improvements in accuracy of messages from international tsunami watch/warning providers.</li> <li>12. FMS investigate access to Pacific sea-level data for tsunami warnings via the GTS with the Bureau including agreement on the Bureau communicating to FMS when instrumentation is out of order.</li> </ol>	

<b>5.3.5. Tsunami warnings</b>	
<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Considerable expertise exists at FMS, MRD Seismology Section and NDMO</li> <li>• FMS operates 24/7 with scientifically astute staff, has established international and national communications links and warning dissemination mechanisms and well established links with media and other agencies.</li> <li>• National seismic analysis and real-time monitoring capability exists at MRD Seismology Section (on-call, but not 24/7), with future potential to automatically alert for locally generated tsunami.</li> <li>• FMS (are 24/7) receive PTWC messages via the GTS, e-mail and SMS to FMS Directors mobile in real time. MRD Seismology Section (not 24/7) receive PTWC messages from FMS (by phone call) and directly from PTWC (email and RANET SMS). <b>(Update May 2009 -</b> The Senior Seismologist has changed phones and is currently not receiving the SMS. FMS does not contact NDMO or Fiji Police Force at the moment, only MRD).</li> <li>• After receiving the message, MRD Seismology Section then value ads by providing Fiji specific threat information before issuing to public (D9 and D10).</li> </ul>	<ul style="list-style-type: none"> <li>• MRD Seismology Section, a key agency in the warning process, is not operational 24/7. In the long term, it would be beneficial to Fiji's tsunami warning system to have local tsunamigenic earthquakes monitored in real-time and fed into timely warnings.</li> <li>• There is potential for panic, false alarms and community complacency if Fiji's tsunami warning system does not include information bulletins for non-tsunamigenic events, felt earthquakes, tsunami that wont impact on Fiji and education post tsunami (regardless of the size of the tsunami). This will be particularly important as awareness of tsunami increases in Fiji. Also, PTWC messages have the potential to be misinterpreted by media without local evaluation and interpretation.</li> <li>• Development of tsunami specific procedural documentation (SOPs, etc) for key agencies is required.</li> <li>• Ongoing tests of Fiji's end-to-end warning system and procedures are required.</li> <li>• Further specific, competency based tsunami related training of staff involved in tsunami warning operations is required (best done based on a comprehensive, agency specific, set of SOPs).</li> <li>• Staff are generally well trained at FMS, however high staff turnover can, at times, leave FMS resource poor.</li> <li>• MRD Seismology Section currently has only one qualified seismologist. High staff turnover is a problem.</li> <li>• Access to a tsunami scenario database (including appropriate training regarding how to use the database) to enable further determination of more specific threat information for Fiji.</li> <li>• Warnings are issued in English only.</li> </ul>



***Tsunami Warnings (Continued)*****Recommendations:**

13. Due to the short time period available for tsunami warning, implement an interim measure whereby FMS issues a "Tsunami Watch" bulletin based on PTWC messages on behalf of MRD, before MRD Seismology Section comes online to qualify the threat.
14. Fiji install a second back-up system at a second 24/7 operational centre to ensure redundancy in receipt of PTWC messages. It is recommended that this be in the form of additional EMWIN systems (Satellite or Internet) at a second 24/7 centre.
15. Include in tsunami warning processes, issuing of "No threat" messages to the public and media for the following events:
  - a. Felt earthquakes that are not large enough to generate tsunami;
  - b. Tsunami that do not have the potential to threaten Fiji; and
  - c. Under-sea earthquakes that do not have the required characteristics to generate a tsunami.

This will prevent misinterpretation of information for sources external to Fiji, as well as maintaining practiced operational systems and community awareness when there is a long time between events.
16. The TWG, as part of SOPs, discuss, develop and implement a tsunami warning distribution list for the responsible agency to use in the case of a tsunami event. Ensure this list is agreed to by appropriate stakeholders and regularly maintained.
17. Ensure staff are adequately trained, including:
  - a. Completing training needs analysis of staff tsunami knowledge and skills in key warning agencies (MRD Seismology Section and FMS) and response agencies (NDMO, Fiji Police Force etc.). Based on this needs analysis, develop a competency based training program to address the identified training gaps of each agency.
  - b. Possible topics identified throughout this process, in which relevant agencies may require further training include:
    - o Tsunami warning decision processes;
    - o SOPs;
    - o Model scenario interpretation;
    - o Sea level data analysis;
    - o Tsunami science and behaviour;
    - o Communication systems;
    - o Information management and networking; and,
    - o Exercise management.

Development of ongoing staff training (including developing links with tertiary institutions and international technical agencies) and incentive programs to ensure maintenance of adequate technical staff in Fiji.
18. As part of SOPs, develop multi-agency and agency specific procedures to handle media and public enquiries and ensure accurate and timely information flow to the media and public during the warning, response and recovery stages of an operational tsunami event. These procedures could include, pre-recorded or text to voice phone warnings, designated spokespeople and topics, talking points, media release templates etc. Incorporate these arrangements into the draft Fiji Tsunami Warning System and Response Arrangements.
19. Incorporate into Fiji's tsunami warning procedures the issuing of tsunami warnings in Fijian, Hindi and English to cater for Fiji's community.

<b>5.3.6. Communications</b>	
<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Communications coverage for whole of Fiji (AM radio at least), with most households having a radio.</li> <li>• Cellular phone networks with SMS available to large population centres and most regional centres. Local carriers are willing to work with SMS distribution systems.</li> <li>• Good multi-agency voice HF/VHF network for land based warnings and good Marine Radio HF/VHF service for coastal and high seas warnings (which are working reliably and effectively in alignment with international protocols).</li> <li>• NDMO have two HF channels to Divisions and Districts and FMS has three meteorological channels used formally for disaster communication.</li> <li>• Police stations key 24/7 contact points for communication.</li> <li>• FMS is receiving government funding to upgrade its communication infrastructure. <b>(Update May 2009 – FMS has spent FJ\$2million over the last two years updating communications equipment).</b></li> <li>• Iridium Satellite phones are available in Government and NGO agencies.</li> <li>• Technical support and expertise for satellite systems and equipment in Fiji is high. MRD Seismology Section is supported and up to date with available satellite technology knowledge.</li> <li>• Siren warning system is being developed for NDMO in conjunction with Cellular carrier. <b>(Update May 2009 - Vodaphone funding has lapsed for tsunami sirens. New funding and a revised project proposal are required).</b></li> <li>• FMS has a compliant GTS node, has numerous redundant international communications systems to receive incoming warnings (EMWIN system used primarily to ensure products sent out through EMWIN are successful, AFTN etc.).</li> <li>• <b>Update May 2009 -</b> Dissemination of warnings is also being discussed with the three telecom providers Telecom Fiji, Digicel and Vodaphone using Suva as a pilot.</li> </ul>	<ul style="list-style-type: none"> <li>• FMS requires improved information on available satellite systems that can be used for efficient dissemination of warning messages (especially in the area of cost effectiveness).</li> <li>• Satellite back-up phones are aging and expensive to use with ongoing costs for VSAT and Satellite (Inmarsat C) phone systems in Fiji is considered too high. Most satellite phones are switched off and used only in an emergency.</li> <li>• HF radio systems need to be data enabled for e-mail (the Navy already has this capability).</li> <li>• Central, up-to-date database required for distributions lists, including satellite phone numbers.</li> <li>• Vodafone has offered a free service for flood and tsunami warnings, but the MoU between Vodafone and the Fiji Government has not been signed as yet and the system is still in a conceptual stage.</li> <li>• FM radio station coverage is good in urban and surrounding rural areas but does not reach all outer areas and is pre-recorded outside hours. AM radio is 24/7 (not pre-recorded) and reaches all areas.</li> <li>• Communication with field officers post a disaster requires improvement.</li> <li>• Improvement in two-way communications with small boat operators required.</li> <li>• <b>Update May 2009 –</b> NDMO have an EMWIN system that is not working. SOPAC operated this system during the last flood. NDMO do not have technicians to maintain operational EMWIN. FMS (who have an EMWIN) can help set up and provide technical EMWIN training.</li> </ul>

*Communications (Continued)*

**Recommendations:**

20. In possible cooperation with Fiji Live or ITC, FMS/NDMO/MRD Seismology Section should consider running an integrated messaging system that manages SMS, e-mail, fax and voice messaging that could be the database for all emergency contacts (including satellite phones), with the possibility of expanding this system to allow for public subscription. This system should maintain the details of active staff at all agencies their roles and operational status and be accessed by the web.
21. Ensure key agencies (FMS, MRD Seismology Section and NDMO) have updated Iridium satellite phones with for international and national voice and SMS backup capability.
22. FMS and other agencies activate their HF e-mail system. This is vital for during disasters when other communication mechanisms may fail.
23. FMS utilise Cellular GPRS for telemetry and also as a potential communications mechanism between its regional offices that have coverage.
24. Investigate and implement (in a multi-hazard framework) an improved mechanism for dissemination of tsunami warnings to the population outside of waking hours, particularly remote villages. For example, a combination of SMS tsunami sirens, dedicated HF radio (email enabled) or VHF radio frequencies, VSAT etc.
25. Investigate options and formalise arrangements with TFL, Digicel, Vodaphone and the Fiji Government to allow SMS messaging and a siren system to be used as mechanisms for warning the Fiji population.
26. Complete an inventory of agency and national communication systems and investigate options for integration. Possibilities include:
  - a. Investigating extending the use of the FMS direct line to Honolulu National Weather Service to PTWC for tsunami warning purposes.
  - b. FMS assisting NDMO to set up and maintain their EMWIN system by training NDMO staff.

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

<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Strong community and agency resilience due to high exposure to natural hazards such as cyclones, storm surges and floods.</li> <li>• Disaster management system in place, with planning and coordination, interagency operability and communications.</li> <li>• NDMO with capability to coordinate preparedness, response and recovery. <b>(Update May 2009</b> - NDMO have no current on call arrangements. They plan to move towards a Duty Officer arrangement).</li> <li>• Emergency response capability provided by a combination of Government agencies, NGOs, the private sector and international organisations. E.g. NDMO, Fiji Police Force, RFMF, NFA, FIMSA, Health Department, Education Department, TFL etc.</li> <li>• Plans are progressing to upgrade NDMO to ensure 24/7 capabilities by activation of a 24/7 NEOC which, they will be otherwise on call. NDMO will then coordinate response agencies through the NEOC <b>(Update May 2009</b> – The NEOC SOPs have been finalised but the National Disaster Management Plan and Act need to be finalised before the SOPs are able to be effective). For example, the RFMS and Fiji Police Force.</li> <li>• MRD Seismology Section’s village tsunami education program encourages villages to establish tsunami evacuation plans and routes using local knowledge.</li> </ul>	<ul style="list-style-type: none"> <li>• Development of evacuation plans and infrastructure for tsunami is required including evacuation routes, signage, identified tsunami refuges, sirens, etc. This is an ongoing project requirement. <b>(Update May 2009</b> - Suva City Council has agreed on evacuation routes and billboards and signage to communicate these evacuation routes to the community in low lying areas of Suva. International signage will be used. A test will occur once plans are implemented. NDMO is currently looking for funding).</li> <li>• Communication with evacuation agencies to mobilise during an event requires improvement.</li> <li>• Development of tourism/hotel and other sector evacuation plans for tsunami is required.</li> <li>• Further specific training of response staff in tsunami related issues is required.</li> <li>• Further emergency response coordination between agencies involved.</li> </ul>
<b>Recommendations:</b>	
<p><b>27.</b> Exercise the tsunami warning system and response procedures by conducting regular multi-agency exercises to facilitate coordination across Government and expose gaps and shortcomings. Exercises should include post exercise debriefs to ensure continuous improvement. It is preferable that exercises are conducted on an annual basis (at least at the strategic level) with full deployment exercises conducted every second year at all levels (National, Divisional and District) to test the tsunami warning system and response arrangements.</p> <p><b>28.</b> Continue to prepare evacuation plans for villages, major urban centres and across sectors that may have special requirements (such as tourism) and incorporate these plans into the Fiji Tsunami Warning System and Response Arrangements as well as associated agency SOPs.</p> <p><b>29.</b> Ensure NDMO has the resources it needs to fulfil the agencies responsibilities under the National Disaster Management Act and Plan. This should include ongoing refurbishment of operations centre and implementation of a 24/7 Duty Officer arrangement.</p>	

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

<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Information available for a number of areas to underpin risk assessments and emergency planning.</li> <li>• The SERMP Project produced a Suva hazard map for tsunami.</li> <li>• GA has completed a preliminary tsunami hazard assessment of the Southwest Pacific as well as a probabilistic study. Both of these studies include Fiji.</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen structural and non-structural mitigation by integrating risk assessments into the planning process (town and land use, evacuation, etc.)</li> <li>• Use existing tsunami hazard studies and records of historical events to identify coastal communities at risk and begin mitigation and preparedness planning.</li> <li>• Tsunami inundation modelling for Suva has been completed but remains unused to date.</li> <li>• Enhanced topographical data and higher resolution bathymetry data to determine specific potential inundation caused by tsunami and storm surges (cyclone).</li> </ul>
<b>Recommendations:</b>	
<ol style="list-style-type: none"> <li>30. Use the tsunami hazard studies that have been completed for the Southwest Pacific Nations (D13, D19) to date and any historical tsunami records, to identify at low-lying communities which may be potentially prone to tsunami impacts and commence tsunami mitigation, response and evacuation planning using local knowledge.</li> <li>31. Use the available inundation modelling for the Suva area (Suva hazard map) to assess and quantify likely impacts and continue to progress planning.</li> <li>32. Continue implementation of risk reduction recommendations from the SERMP project (D19, 2002) and consider extension to other urban areas.</li> <li>33. Continue capacity building in tsunami risk assessment, GIS use and tsunami modelling including implementing mechanisms to make people aware of what GIS data is available and what work is being undertaken.</li> <li>34. Acquire the necessary baseline data for other urban areas as part of a multi-hazard mapping activity. This will include acquiring high resolution topography (Light Detection and Ranging (LiDAR)) data of low-lying major urban areas (such as Nadi and Lautoka) as well as high resolution bathymetry data (for Nadi Bay and Lautoka area) to assist multi-hazard assessments, modelling and mapping (e.g. storm surge, climate change and tsunami). Current data available in Fiji is outlined in the report "Inventory of Geospatial Data and Options for Tsunami Inundation &amp; Risk Modelling, Fiji Islands" (D11).</li> <li>35. Partner with regional or international organisations to conduct paleo-seismic and paleo-tsunami studies to extend and enhance historical event records.</li> <li>36. Investigate future, long-term options for completing tsunami inundation modelling, particularly for large population and infrastructure centres. Ensure consideration is given to software, hardware and the information technology capacity to analyse, interpret and use this information in operations.</li> <li>37. Work towards development of an information management system/database that enables various hazard and vulnerability data to be turned into a decision making tool for relevant Government departments. Incorporate available GIS data into this database and continue capacity building in GIS use in-country.</li> </ol>	

**5.3.9. Public and Stakeholder Awareness and Education**

Strengths:	Opportunities for Improvement:
<ul style="list-style-type: none"> <li>• MRD Seismology Section has plans to deliver a community awareness program to all coastal villages. To date over 300 coastal villages have received the program with more than 700 coastal communities targeted. This program is funded out of MRD Seismology Section's budget. Lack of funding is a current issue. <b>(Update May 2009</b> - MRD Seismology Section's tsunami awareness program has been integrated with NDMO into an all hazards program for rural coastal communities).</li> <li>• MRD Seismology Section has developed educational material on tsunami and earthquake specific to tsunami (D1, D4a, D8).</li> <li>• A Tsunami Awareness Kit for Fiji was developed in 2005 by the PDC in collaboration with Fiji experts, SOPAC, and with support from the IOC's ICG/PTWS. The kit contains significant country-specific materials (e.g. earthquake and tsunami historical events, maps, emergency response procedures). The kit has been distributed to schools for use in school education. Other international information such as Tsunami Teacher is also available.</li> </ul>	<ul style="list-style-type: none"> <li>• The short lead time available for responding to local tsunami requires comprehensive and routine community awareness programs for coastal communities at risk.</li> <li>• Community complacency may arise due to frequency of warnings for other hazards, tsunami false alarms as a result of insufficient information, and/or lack of education of actual, but small events.</li> <li>• Further funding and work is required to ensure community preparedness and awareness in remaining coastal villages and urban centres.</li> <li>• Education materials (both nationally developed and internationally available materials) may require translation into other languages to cater for the culturally and linguistically diverse community.</li> <li>• Ongoing testing and assessment of community awareness is important to gauge the success of education programs and to focus efforts.</li> <li>• Work should be completed to build the tsunami hazard into community awareness programs for other hazards, leading to a multi-hazard approach. <b>(Update May 2009</b> – A more integrated approach between key agencies is now being taken to training, awareness, exercises and development of disaster plans for schools and community. Key agencies include FMS, MRD, NDMO, NFA, St John's Ambulance, Police and the Red Cross).</li> <li>• Funding for development of tsunami community awareness programs in Fiji is intermittent.</li> <li>• Key agencies work closely with the media and acknowledge their importance however media training specific to tsunami and tsunami warnings could be improved.</li> </ul>

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

- 38.** Build on the tsunami community awareness program developed by the MRD Seismology Section with the aim of establishing a comprehensive national tsunami public education and awareness program reaching all sectors of the Fiji community. This program should be based on the knowledge of which communities are at risk where possible and fed into a multi-hazard, agency coordinated approach. Including:
- a.** Focus on key “Tsunami Safety Rule” messages outlined in MRD Seismology Section print material (MRD Information Note 5);
  - b.** Separate Tsunami Safety Rules into two categories (1) Be prepared for a tsunami – with messages such as plan a tsunami evacuation route in your village and (2) Take action in the case of a tsunami – with messages such as stay out of dangerous areas until the all clear is given by the authority;
  - c.** Enhancement of key messages to explain the different scale of tsunami with words such as “even a small tsunami that does not wash onto land could cause danger to swimmers and damage to marine vessels”;
  - d.** Incorporate evaluation into programs to review the effectiveness of the program. For example, what worked, what did not, and where resources and funds should be focused;
  - e.** Identify dialect / language groups that may require tailored programs;
  - f.** Identify other community / business sectors that may require tailored programs (e.g. tourism and hotels);
  - g.** Continue the use and development of the suite of materials for public education, utilising existing national and international materials wherever possible;
  - h.** Consider the use of electronic media for delivery of educational messages (e.g. TV and Radio);
  - i.** Network with regional / international agencies, such as the ITIC regarding funds and materials; and,
  - j.** Incorporate delivery of tsunami awareness activities into annual work plans and budget proposals.
- 39.** Incorporate tsunami into a multi-hazard media education program to assist the media to understand hazards and associated warnings and procedures, therefore passing the correct information onto the Fiji community.
- 40.** Develop a plan for tsunami education to occur regularly post a tsunami event. This is particularly important if a warning was issued and a small tsunami was generated that created unusual rips and currents. It is important to educate the public that it was not a false alarm to maintain confidence the tsunami warning system.
- 41.** Include action prompts (pre agreed between relevant agencies) in tsunami warnings advising the community on action to take pre, during and post the tsunami event.

## 5.4. Additional Workshop Benefits

In addition to this report, benefits of the Tsunami Capacity Assessment Workshop in Fiji were:

- Facilitation of working relationships between agencies and organisations involved in tsunami warning and mitigation within Fiji;
- Exchange of information on National activities and capabilities within Fiji;
- Enhanced working relationships between the Fiji participants, the Bureau, AGD and SOPAC; and
- Visiting assessment team will update the relevant Bureau Registered User Website and ensure that both FMS and MRD Seismology Section can access real-time sea level data.

## 5.5. Next Steps

Fiji 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 summaries 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 to facilitate further capacity development projects being undertaken based on the results of this project.





Section

6

## 6. Annexure



## 6. Annexure

### 6.1. Annexure 1 – Record of Participants

Organisation Name	Prefix	First Name	Last Name	Position/Department	Work Phone	Mobile	Fax No.	E-mail
Fiji Police Force	IP	Iokimi	Navonu	Unit Commander Police Mobile Division	3393322	9302771	3396080	<a href="mailto:kimikosovo@yahoo.com">kimikosovo@yahoo.com</a>
Fiji Navy	Mr.	John	Fox	Lieutenant Commander	3315370	9454909	3306295	<a href="mailto:jjfox70@hotmail.com">jjfox70@hotmail.com</a>
Fiji Navy	Mr.	Joeli	Cawaki	Director-Maritime	3313799	9964635	3313397	<a href="mailto:jrcawaki@yahoo.com.au">jrcawaki@yahoo.com.au</a>
Fiji Police Force	Sgt	Kasiano	Vuso	Station Officer Nausori	3477222	9905754	3478958	-
Fiji Police Force	CPL	Tomasi	Bulimaibau	Police Mobile Division Command Centre	3393322	9382541	3396080	<a href="mailto:rasalato.tomasi@yahoo.com">rasalato.tomasi@yahoo.com</a>
Fiji Police Force	IP	Manueli	Nayasi	OC-Southern Division Command Centre	338400 ext 273	9380697		-
Fiji Police Force	AASP	Jone	Baravi	Divisional Charge Manager-West	6660222	9931434	6669870	<a href="mailto:baravi_fj@yahoo.com">baravi_fj@yahoo.com</a>
Fiji Police Force	ACP	Sosioceni	Tamani	Operations Officer NCOC-Suva	3318526		3308610	<a href="mailto:tamanisosi@yahoo.com">tamanisosi@yahoo.com</a>
Fiji Police Force	IP	Kelera	Nakulanikoro	National Coordinator-Crime Stoppers	3311222 ext 1320		3319222	<a href="mailto:nkelera@yahoo.com">nkelera@yahoo.com</a>
Fiji Police Force	IP	Eroni	Gadolo	Operations Officer-Central Police Station	3311222 ext 1216	9313364	3478958	-
Fiji Police Force	IP	Narendra	Kumar	Divisional Officer Training Eastern	3478177	9277863	3478958	<a href="mailto:IP.Narend@yahoo.com">IP.Narend@yahoo.com</a>
FIMSA	APM	Jesse	Dunn	Acting Port Manager	3304449	9355746	3304449	<a href="mailto:peni@fpcl.com.fj">peni@fpcl.com.fj</a>

Organisation Name	Prefix	First Name	Last Name	Position/Department	Work Phone	Mobile	Fax No.	E-mail
Ministry of Environment	Mr.	Waisea	Vosa					
Ministry of Environment	Mrs.	Senivasa	Waqairamasi	National Coordinator-National Capacity Self Assessment	3310858/3 311699 ext 114		3312879	<a href="mailto:senivasa.waqairamasi@govnet.gov.fj">senivasa.waqairamasi@govnet.gov.fj</a>
MRD	Mr.	Sakaraia	Vunisa	Technical Officer II	3381611	9371766	3370039	<a href="mailto:sakaraia@mrd.gov.fj">sakaraia@mrd.gov.fj</a>
NDMO	Mr.	Pajilliai	Dobui	A/Principal	3313400		3319315	<a href="mailto:pajilliai.dobui@govnet.gov.fj">pajilliai.dobui@govnet.gov.fj</a>
NFA	Mr.	Qionilau	Moceitai	DPO CE	3312877	9301578	3303348	<a href="mailto:g.moceitai@nfa.gov.fj">g.moceitai@nfa.gov.fj</a>
Royal Fiji Military Forces	Major	Aisake	Daulako	SO OPS/Plans		9775689		<a href="mailto:aisake63@yahoo.com">aisake63@yahoo.com</a>
Royal Fiji Military Forces	Mr.	Viliame	Finemateaki	TRG Officer RFMF Engineers	3385222 ext 1510			<a href="mailto:mateakifine@hotmail.com">mateakifine@hotmail.com</a>
Telecom Fiji	Mr.	Kemueli	Musunamasi	STO-Network Management Centre	3210314	9740791		<a href="mailto:kemueli.musunamasi@tfl.com.fj">kemueli.musunamasi@tfl.com.fj</a>
Telecom Fiji	Mrs.	Meri	Vaniqi	Team Leader-National Management Centre	3210313	3541566		<a href="mailto:mere.vaniqi@tfl.com.fj">mere.vaniqi@tfl.com.fj</a>
Telecom Fiji	Mr.	Manoa	Dugulele	Manager-Rural Services	3210287	9954737		<a href="mailto:manoa.dugulele@tfl.com.fj">manoa.dugulele@tfl.com.fj</a>
Seismology Section, Mineral Resources Department	Mr.	Lasarusa	Vuetibau	Senior Seismologist	679 338 1611	679 337 0039		<a href="mailto:lasarusa@mrd.gov.fj">lasarusa@mrd.gov.fj</a>
Fiji Islands Maritime Safety Administration	Mr.	Simione	Telilai	Pollution Officer				<a href="mailto:peni@fpcl.com.fj">peni@fpcl.com.fj</a>
Ministry of Provincial Development	Mr.	Joeli	Rokovanda	Commissioner Western				<a href="mailto:jrokovada@govnet.gov.fj">jrokovada@govnet.gov.fj</a>

Organisation Name	Prefix	First Name	Last Name	Position/Department	Work Phone	Mobile	Fax No.	E-mail
Mineral Resources Department	Mr.	Eroni	Taupua	Technical Officer				<a href="mailto:eroni@mrd.gov.fj">eroni@mrd.gov.fj</a>
Fiji Police Force	Mr.	Saini	Tale					<a href="mailto:telesaini@gmail.com">telesaini@gmail.com</a>
Fiji Meteorological Service	Mr.	Rajendra	Prasad	Director	679 672 4888		679 6720430	<a href="mailto:rajendra.prasad@met.gov.fj">rajendra.prasad@met.gov.fj</a>
Fiji Meteorological Service	Mr.	Alipate	Waqaicelua	Principal Scientific Officer (Services Development)	679 672 4888	679 9905379	679 6720430	<a href="mailto:alipate.waqaicelua@met.gov.fj">alipate.waqaicelua@met.gov.fj</a>

## 6.2. Annexure 2 – The visiting assessment team

Team Position	Name	Position within Organisation	Organisation	Contact Details
Team Leader (Project Leader)	Rick Bailey	Project Director, Australian Tsunami Warning System	Australian Bureau of Meteorology	<a href="mailto:r.bailey@bom.gov.au">r.bailey@bom.gov.au</a> Ph. +61 3 9669 4103 Fax: +61 3 9669 4803
Natural Hazard Warning Expert	Sarwan Dey	Senior Meteorologist National Meteorological and Oceanographic Centre	Australian Bureau of Meteorology	<a href="mailto:s.dey@bom.gov.au">s.dey@bom.gov.au</a> Ph. +61 3 9669 4035 Fax. +61 3 96621222
Emergency Management Expert	Peter Willett	Assistant Director, Emergency Planning and Coordination	Emergency Management Australia	<a href="mailto:Peter.Willett@ema.gov.au">Peter.Willett@ema.gov.au</a> Ph. +61 2 6256 4776 Fax. +61 2 6256-4653
Data Communications Expert	Bryan Hodge	Data Communications Specialist	Australian Bureau of Meteorology	<a href="mailto:b.hodge@bom.gov.au">b.hodge@bom.gov.au</a> Ph. +61 3 9669 4858 Fax. +61 3 9669 4803
Regional Expert	Michael Bonte- Grapentin	Risk Assessment Specialist	Pacific Islands Applied Geoscience Commission	<a href="mailto:Michael@sopac.org">Michael@sopac.org</a> Ph. +679 (338) 1377 Fax. +679 (337) 0040
Project Manager	Cherie O'Brien	Project Manager – SOPAC Member Countries Tsunami Capacity Assessments	Australian Bureau of Meteorology	<a href="mailto:c.o'brien@bom.gov.au">c.o'brien@bom.gov.au</a> Ph. +61 3 9669 4065 Fax. +61 3 9669 4803

### 6.3. Annexure 3 – Agenda, Fiji Tsunami Capacity Assessment Workshop

## National Capacity Assessment of Fiji’s Tsunami Warning and Mitigation System

### WORKSHOP AGENDA 11 – 14 March 2008

#### DAY 1: Tuesday 11 March 2008

#### SESSION 1: OPENING CEREMONY AND INTRODUCTORY PRESENTATIONS

LOCATION: Holiday Inn, Victoria Parade, Suva

CHAIR: Rick Bailey, Australian Bureau of Meteorology

Time	Item	Questionnaire Reference	Duration	Participation
9.00 – 9.30am	Registration / Tea and Coffee	NA	0.5hr	Open
9.30 - 10.30am	Opening Ceremony	NA	1hr	Open
10.30 – 11.00am	Official Opening Morning Tea	NA	0.5hrs	Open
11.00 – 11.30am	<p>Presentation – Visiting Assessment Team Leader</p> <ul style="list-style-type: none"> <li><i>Introduction to the tsunami capacity assessment project</i></li> </ul> <p><b>Presenter: Rick Bailey</b></p>	NA	0.5hrs	Open
11.30 – 12.30pm	<p>Presentations – Fijian Experts</p> <ul style="list-style-type: none"> <li><i>Tsunami warning and mitigation in Fiji</i></li> </ul> <p><b>Presenter/s: Rajendra Prasad, Fiji Meteorological Service and Lasarusa Vuetibau, Mineral Resources Department</b></p>	NA	1hr	Open

Time	Item	Questionnaire Reference	Duration	Participation
12.30 – 1.30pm	Lunch	NA	1hr	Open
<b>SESSION 2: ORGANISATIONS, COMMITTEES, LEGISLATION, STRATEGY AND COOPERATION</b>				
<b>LOCATION: Holiday Inn, Victoria Parade, Suva</b>				
<b>CHAIR: Rick Bailey, Australian Bureau of Meteorology</b>				
Time	Item	Questionnaire Reference	Duration	Participation
1.30 – 2.30pm	<i>Focus Groups - Fiji's priorities for implementing an effective tsunami warning and mitigation system</i>	Section 4	1hr	Open
2.30 – 3.30pm	<b>Capacity Assessment – Organisations, Committees and Legislation</b>			
	<i>Organisations involved in tsunami warning and mitigation in Fiji</i>	Section 2, Part A	1hr	Open
	<i>Tsunami warning and mitigation coordination committees at National, Provincial and Community level in Fiji</i>	Section 2, Part B		
	<i>Legislation relevant to tsunami warnings and emergency response</i>	Section 2, Part C		
3.30 – 4.00pm	Afternoon tea	NA	0.5hrs	Open
4.00 – 5.00pm	<b>Capacity Assessment – Strategy, International and Regional Cooperation, All Hazards Approach</b>			
	<i>Disaster risk reduction strategy in Fiji</i>	Section 2, Part D	1hr	Open
	<i>International and Regional cooperation for tsunami warning and mitigation in Fiji</i>	Section 2, Part E & F		
	<i>All-hazards approach</i>	Section 3		
5.00pm	<b>CLOSE</b>			



<b>DAY 2: Wednesday 12 March 2008</b>				
<b>SESSION 3: RESEARCH, MONITORING AND WARNING</b>				
<b>LOCATION: Holiday Inn, Victoria Parade, Suva</b>				
<b>CHAIR: Cherie O'Brien, Australian Bureau of Meteorology</b>				
<b>Time</b>	<b>Item</b>	<b>Questionnaire Reference</b>	<b>Duration</b>	<b>Participation</b>
9.00 – 9.30am	<b>Setting the Scene: Tsunami Warnings &amp; Communication</b> <i>Presenter: Sarwan Dey &amp; Bryan Hodge</i>	NA	0.5hrs	Open
9.30 – 11.30am	<b>Capacity Assessment – Research, Monitoring, Warning and Emergency Response</b>			
9.30 – 10.00am	<i>Research and development expertise</i>	<i>Section 5</i>	<i>0.5hr</i>	<i>Open</i>
10.00 – 10.30am	<b>Tsunami monitoring including:</b> <ul style="list-style-type: none"> <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 3 May 2006 Tongan Trench Event</i></li> </ul>	<i>Section 6, Part A, B, C &amp; Case Study – Monitoring Systems</i>	<i>0.5hrs</i>	<i>Open</i>
10.30 - 11.00am	<b>Morning Tea</b>	NA	0.5hrs	Open
11.00 – 1.00pm	<b>Tsunami warning system in Fiji including:</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> <li><i>Procedures for dissemination of tsunami warnings Nationally, once received from PTWS</i></li> </ul>	<i>Section 7, Part A, B, C, D, E, F, G, Case Study – Tsunami Advisory Messages and Warnings &amp; Part H</i>	<i>2hrs</i>	<i>Open</i>

Time	Item	Questionnaire Reference	Duration	Participation
	<p><b><i>Tsunami warning system in Fiji <u>continued</u> including:</i></b></p> <ul style="list-style-type: none"> <li><i>Issuing warnings for marine vessels, harbours and ports</i></li> <li><i>Case Study – Receipt of international advisories and dissemination of warnings nationally for the 3 May 2006 Tongan Trench Event</i></li> <li><i>CONCLUSION – Strengths and weaknesses of tsunami warnings</i></li> </ul>	As above	As above	As above
1.00 – 1.30pm	Lunch	NA	0.5hr	Open
<b>SESSION 4: SITE TOURS</b>				
LOCATION: Various				
CHAIR: NA				
1.30 – 5.00pm	Visiting assessment team tours of sites and facilities important to tsunami warning and mitigation within Fiji.	NA	3.5hrs	Relevant Agencies & Assessment Team

<b>DAY 3: Thursday 13 March 2008</b>				
<b>SESSION 5: TSUNAMI EMERGENCY RESPONSE, MITIGATION AND PREPAREDNESS</b>				
<b>LOCATION: Holiday Inn, Victoria Parade, Suva</b>				
<b>CHAIR: Cherie O'Brien, Australian Bureau of Meteorology</b>				
<b>Time</b>	<b>Item</b>	<b>Questionnaire Reference</b>	<b>Duration</b>	<b>Participation</b>
9.00 – 9.30am	<b>Setting the Scene: Risk Assessment, Emergency Planning &amp; Community Awareness</b> <i>Presenter: Michael Bonte &amp; Peter Willett</i>	NA	0.5hrs	Open
9.30 – 10.30am	<b>Emergency response to tsunami in Fiji</b> <ul style="list-style-type: none"> <li>• <i>Assessing the capacity of the disaster management system in Fiji 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	1hr	Open
10.30 – 11.00am	<b>Morning Tea</b>	NA	0.5hrs	Open
11.00 – 12.30pm	<b>Emergency response to tsunami in Fiji <u>continued</u> including:</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 Non-Government organisations in tsunami warning and mitigation</i></li> <li>• <i>Case Study – Preparedness and response for the 3 May 2006 Tongan Trench Event</i></li> </ul>	Section 8, Part D, E, F, G, H & Case Study – Preparedness and Response	1.5hrs	Open

Time	Item	Questionnaire Reference	Duration	Participation
12.30 – 1.30pm	Lunch	NA	1hr	Open
<b>SESSION 6: TSUNAMI HAZARD, VULNERABILITY AND RISK AND COMMUNITY AWARENESS</b>				
1.30 – 5.00pm	<b>Capacity Assessment – Hazard, Vulnerability and Risk Studies and Community Awareness</b>			
1.30 – 2.30pm	<p><i>Tsunami hazard, vulnerability and risk studies in Fiji including:</i></p> <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>	Section 9, Part A, B, C, D, E, F	1hr	Open
2.30 – 3.00pm	Afternoon Tea	NA	0.5hrs	Open
3.00 – 5.00pm	<p><i>Public and stakeholder awareness and education regarding tsunami in Fiji including:</i></p> <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>	Section 10, Part A, B, C, D	2hrs	Open
5.00pm	CLOSE			

<b>DAY 4: Friday 14 March 2008</b>	
<b>PRESENTATION OF PRELIMINARY ASSESSMENT FINDINGS</b>	
<b>LOCATION: Holiday Inn, Victoria Parade, Suva</b>	
<b>CHAIR: Rick Bailey, Australian Bureau of Meteorology</b>	
<b>Start Time: 9am</b>	
<b>Time</b>	<b>Item</b>
<b>9.00 – 9.30am</b>	<b>Breakfast morning tea (All welcome)</b>
<b>9.30 – 10.30am</b>	<b>Preliminary summary presentation</b> from the visiting assessment team – Fiji’s strengths, needs, preliminary recommendations, priority review and next steps
<b>10.30 – 11.00am</b>	<b>Questions and Feedback</b> from Fiji participants on preliminary summary presentation and the assessment process in general
<b>11.00am</b>	<b>ACKNOWLEDGEMENTS AND CLOSE</b> <ul style="list-style-type: none"> <li>• Assessment Team – Cherie O’Brien and Rick Bailey, Aus. Bureau of Meteorology</li> <li>• Regional Organisation – Michael Bonte, SOPAC</li> <li>• <b>PS for Provincial Development, Multiethnic Affairs, and Disaster Management – Mr Manasa Vaniqi</b></li> </ul>
<b>11.00 – 11.30am</b>	<b>MoU Discussion – ATWS and SPSLCMP (for interested parties)</b>
<b>12.30pm</b>	<b>Lunch</b>

## 6.4. Annexure 4 – Supporting Documents Log

Ref.	Document Name	Copy Obtained (Y/N)	Format (H = Hard Copy) (E = Electronic)
D1	Web Resources, Earthquakes and Tsunami in Fiji (Fiji Mineral Resources Department, Downloaded 10.10.2006)	Y	H & E
D2	Natural Disaster Management Act 1998	Y	H & E
D3	National Emergency Operations Centre Standard Operating Procedures (Draft 4 – 12.10.2006)	Y	H & E
D4a	DRAFT Fiji Tsunami Warning System and Response Arrangements (Fiji Mineral Resources Department, 14.3.2004)	Y	H & E
D4b	Brochure – Fiji Earthquakes (Fiji Mineral Resources Department, Revised Edition, 2004)	Y	H & E
D5	Briefing Paper - National Disaster Risk Management Structure and National Disaster Management Office (NDMO) Projects / Activities, 2006	Y	H & E
D6	Tsunami Steering Committee Update Report (date unknown)	Y	H & E
D7	Tsunami Workshop Report (4th August 2006)	Y	H & E
D8	MRD Information Notes 5 – Tsunami (Fiji Mineral Resources Department, September 1991)	Y	H & E
D9	Tsunami Warning for Solomon Islands Tsunami (Fiji Mineral Resources Department, 2/04/07)	Y	H & E
D10	Cancellation of Fiji Tsunami Warning (Fiji Mineral Resources Department, 2/04/07)	Y	H & E
D11	Inventory of Geospatial Data and Options for Tsunami Inundation & Risk Modelling, Fiji Islands (SOPAC/GA Tsunami Hazard and Risk Assessment Project, February 2008)	Y	H & E
D12	Preliminary Feedback for Participants of Exercise Pacific Wave 2006, Fiji (Atu Kaloumaira and Joeli Rokovada)	Y	H & E
D13	A Preliminary Study into the Tsunami Hazard faced by Southwest Pacific Nations (Geoscience Australia, 22 June 2007)	Y	H & E
D14	Bibliography – Seismic and Tsunami Hazard Fiji	Y	H & E
D15	Tariq Rahiman's thesis on the 1953 earthquake and tsunami in the Fiji reference docs	N	E
D16	Fiji National Disaster Management Plan 1995	Y	E
D17	Fiji National Disaster Risk Management Arrangements 2006 (Final Draft)	Y	E
D18	Tsunami Mitigation for the City of Suva, Fiji	Y	E
D19	A Probabilistic Tsunami Hazard Assessment of the Southwest Pacific Nations	Y	E

## 6.5. Annexure 5 - Visit to Nadi Regional Specialised Meteorological Centre

A visit to Nadi Regional Specialised Meteorological Centre, operated by Fiji Meteorological Service (FMS), was undertaken by part of the visiting assessment team prior to the commencement of the Tsunami Capacity Assessment Workshop. The visit was primarily aimed at helping the visiting assessment team gain an improved understanding of the operations and resources available at Nadi. Initial talks were held with Mr Rajendra Prasad, the Director, and then a group meeting was held with available technical and operational staff to discuss specific issues in communication systems. Outcomes of the discussion included:

- FMS wish to be more involved and have staff that could offer significant contribution to the Pacific Communications Steering Group and RANET program. This should be looked at in any future AusAID applications under the PGSP.
- Vodaphone is offering a GPRS data service on the Cellular network for approx \$28 FJD per month. FMS are unsure how to utilise this technology to enhance the Automatic Weather Station (AWS) network, which is suffering from a number of issues. FMS have a desire for more frequent data from these sites.
- As the Australian Tsunami Warning System (ATWS) Project is looking for a backup system for the Suva and Lautoka Sea Level installations, assistance could be given to the FMS as the technical work needed under the ATWS upgrade would apply equally to the FMS AWS program. The ATWS will work with FMS technical staff to see if a solution can be applied to the sea level gauge and the FMS AWS sites.
- The FMS were also undertaking as significant communications upgrade of CISCO equipment and indicated that assistance from the Bureau would be may be requested to install this equipment .

## 6.6. Annexure 6 – 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.

## 6.7. Annexure 7 – 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.
- Republic of the Fiji Islands Country Brief - April 2008, Australian Department of Foreign Affairs and Trade, Canberra, viewed January, 2009, <[http://www.dfat.gov.au/geo/fiji/fiji\\_brief.html](http://www.dfat.gov.au/geo/fiji/fiji_brief.html)>
- About Fiji, Fiji Government Online, viewed January, 2009, <[http://www.fiji.gov.fj/publish/cat\\_about\\_fiji.shtml](http://www.fiji.gov.fj/publish/cat_about_fiji.shtml)>
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- Terminology: Basic terms of disaster risk reduction March 2004, United Nations, International Strategy for Disaster Reduction, viewed January, 2007, <<http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm>>

## Annexure 7 – References (Continued)

- About Fiji, University of the South Pacific, Suva, Fiji, viewed January, 2009, <[http://www.usp.ac.fj/index.php?id=newstaff\\_aboutfiji](http://www.usp.ac.fj/index.php?id=newstaff_aboutfiji)>
- Vuetibau, L., 2004 revised edition. *Fiji Earthquakes*. Fiji Mineral Resources Department information brochure or at <<http://www.mrd.gov.fj/gfiji/seismology/fijiearthquakepage.html>>
- Warne, J., 2008, *Summary - Tsunami Threat Source for Fiji Islands*, Australian Government Bureau of Meteorology.



Section

7

## 7. CD Attachment





## 7. CD Attachment - Supporting Documents

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

