

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

Republic of Palau



Republic of Palau



SOPAC



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

Palau

Koror, 11 – 14 August 2009



Document Control

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Acronyms

AGD	Australian Attorney-General's Department
ACP-EU	Africa Caribbean Pacific – European Union
AISR	Aeronautical Information System Replacement
AM	Amplitude Modulated
ATWC	Alaska Tsunami Warning Centre
ATWS	Australian Tsunami Warning System
AusAID	Australian Agency for International Development
Bureau	Australian Bureau of Meteorology
CLT	Crisis Leadership Team
CTBTO	Comprehensive (Nuclear) Test Ban Treaty Organisation
D	Document (for example, Document 39 = D39)
DFAT	Australian Department of Foreign Affairs and Trade
DRM	Disaster Risk Management
EAS	Emergency Alert System
EMA	Emergency Management Australia
EMWIN	Emergency Managers Weather Information Network
EOC	Emergency Operations Centre
FM	Frequency Modulated
FSM	Federated States of Micronesia
GA	Geoscience Australia
GIS	Geographic Information System
GOES	USA NOAA's Geostationary Operational Environment Satellites
GTS	Global Telecommunications System
HF	High Frequency
ICG	Intergovernmental Coordination Group
ICP	Incident Command Post
IFRC	International Federation of Red Cross and Red Crescent Societies
IOC	Intergovernmental Oceanographic Commission
ISDR	International Strategy for Disaster Reduction
IT	Information Technology
ITIC	International Tsunami Information Centre
ITSU	ICG for the Tsunami Warning System in the Pacific
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
JATWC	Joint Australian Tsunami Warning Centre
JMA	Japan Meteorological Agency
LiDAR	Light Detection and Ranging
MOE	Ministry of Education
MoH	Ministry of Health
Mw	Moment Magnitude
NDRMF	National Disaster Risk Management Framework (2009 Framework to replace the National Disaster Plan 1998)
NEC	National Emergency Committee
NEMO	National Emergency Management Office
NEOC	National Emergency Operations Centre
NGOs	Non-Government Organisations
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
NZ	New Zealand
OERC	Office for Environmental Response and Coordination
PALARIS	Office of the Palau Automated Land And Information System
PCC	Palau Community College
PEACESAT	Pan-Pacific Education And Communication Experiments by SATellite
PGSP	Pacific Governance Support Programme

Acronyms (Continued)

PICs	Pacific Island Countries
PIF	Pacific Island Forum
PNCC	Palau National Communication Corporation
PNG	Papua New Guinea
PPRR	Prevention, Preparedness, Response and Recovery
PTWC	Pacific Tsunami Warning Centre
PTWS	Pacific Tsunami Warning and Mitigation System
RANET	RAdio and InterNET for the Communication of Hydro-Meteorological Information for Rural Development
RF	Radio Frequency
RICS	Rural Internet Connectivity System
SMS	Short Message Service
SOPAC	Pacific Islands Applied Geoscience Commission
SOPs	Standard Operating Procedures
SPREP	South Pacific Regional Environmental Programme
TAF / OFDA	The Asia Foundation (TAF) for the Office of U.S. Foreign Disaster Assistance (OFDA)
TV	Television
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
USAID	United States Agency for International Development
UTC	Coordinated Universal Time
VHF	Very High Frequency
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 Palau (hereafter referred to as “Palau”) to receive, communicate and effectively respond to tsunami warnings took place in a workshop held from 11 – 14 August 2009 in Koror, Palau.

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

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

Palau’s draft Palau National Disaster Risk Management Framework (NDRMF, D2, 2009) lists tsunami as a low level risk under the natural hazards profile. A number of small tsunami events (generally less than 10 cm in amplitude) have been recorded in the past on Palau’s third party sea level gauges at Pohnpei, Malakal and Yap. The main tsunami threat sources to Palau are the Philippines and New Guinea trenches. Palau needs to be aware that short travel times from these nearby sources (of 1 to 1.5 hours) translate to only 30 to 50 minutes of time to warn the community to take appropriate action in the event of a tsunami.

Due to the physical nature of the island group Palau, is not under a great tsunami threat. However, there are some specific considerations for the country. Low lying farming land has been flooded during king tides in the past. These, and similar low-lying areas, are vulnerable to tsunami. The isolation of Palau’s southern island States also greatly increases their vulnerability. Finally, Palau’s economy is highly dependent on tourism. In addition to Palau’s coastal way of life, much of this tourism relates to water activities such as diving and snorkelling. Typically, significant currents are associated with tsunami, even for small events. Local currents may be two or three times greater than those experienced under normal conditions. This should be taken into consideration when assessing the risk of small events to marine activities. People in the water during a tsunami are at significant risk due high currents associated with even small tsunami.

Palau’s National Disaster Plan (1998, D1) exists and is in the final stages of being reviewed and replaced by the draft NDRMF (D2). The current 1998 plan is legislated by Executive Order No. 166-99. However, tsunami warning roles and responsibilities are not clearly articulated in the 1998 plan and therefore not legislated. State level disaster plans exist across Palau’s 16 States. These too are lacking in inclusions specific to the hazards experienced by that community. Currently, a tsunami response, evacuation and recovery plan does not exist. Palau is progressing Disaster Risk Management (DRM) nationally in an all-hazards framework. Between 2010 and 2012, Palau will undertake a DRM National Action Planning process (supported by SOPAC under the Africa Caribbean Pacific – European Union (ACP-EU) National Disaster Facility) to guide strategic planning effort in the short to medium term.

Palau has limited in-country research currently being undertaken to further develop the country's ability to manage natural disasters, including tsunami. However, a number of government agencies and NGO's in-country (particularly those currently working in environmental conservation of Palau's unique marine environment) have demonstrated capacity to develop their skills in this area. Further use of available scientific tools would enable Palau to make a more accurate interpretation of the tsunami threat to their country after advice is received from international warning centres.

The 24/7 Palau National Weather Service (NWS), which is supported by United States of America's National Oceanic and Atmospheric Administration (USA NOAA) and receives international tsunami messages primarily from the Pacific Tsunami Warning Centre (PTWC) as well as the Guam and Honolulu NWS Offices. Japan Meteorological Agency (JMA) and Alaska Tsunami Warning Centre (ATWC) tsunami messages are received but generally not used. Messages are received through e-mail, fax, Emergency Managers Weather Information Network (EMWIN), Aeronautical Information System Replacement (AISR) (which has an audio alert) and through the internet via the Palau National Communication Corporation (PNCC). Currently, national warnings are issued by the National Emergency Management Office (NEMO) (who are not 24/7), after receiving advice from the NWS. If the tsunami threat is verified NEMO coordinates with the NEC and the President's office to approve Palau tsunami warning messages (including evacuation). The President activates the NEOC with NEMO assistance.

Processes currently exist for dissemination of tsunami warnings nationally. However, these processes are lengthy and complex, which could lead to a delay in issuing effective advice to the community. Palau has three sea level gauges and one seismic station in-country (installed by third parties). This data is not currently incorporated into Palau's tsunami warning processes.

Participants in the workshop stated a number of priority areas for improvement that need to be addressed. Recurring themes included improved emergency response planning, enhancement of tsunami awareness in the community, enhancement of communications systems and identification of communities and groups at risk from tsunami. The workshop's resulting recommendations reflected these priorities. Very high priority recommendations made include:

- Approve, adopt and implement the draft Palau NDRMF (D2) and progress towards incorporating this framework into legislation.
- Each agency and organisation complete a multi-hazard DRM plan which considers tsunami (fast onset hazards) in line with their responsibilities outlined in the National Disaster Plan (1998, D1) and revised NDRMF when approved (D2).
- On formal approval of the NDRMF (D2) develop a Palau National Tsunami Response Sub-Plan to clearly articulate Prevention, Preparedness, Response and Recovery (PPRR) for tsunami on a national level including mitigation, warning, response and regular testing of the system.
- Enhance the NEC to ensure a multi-stakeholder forum exists to address DRM in a multi-hazard context.
- All agencies with key roles to play in the tsunami warning and mitigation systems are adequately resourced to carry out their nominated functions under the National Disaster Plan (1998, D1) (and revised framework when approved, D2).
- That the full authority and responsibility for analysing and interpreting tsunami messages, tsunami data, and sending out tsunami warnings for Palau is formally delegated to the Palau NWS Office based on a pre-agreed warning matrix.
- Develop, approve, share and maintain national tsunami warning and response Standard Operating Procedures (SOPs) for each agency involved in the tsunami warning and response process.
- Improve redundancy in warning communication and improve communication mechanisms to the remote Southwest Islands, including training and education for effective use and maintenance of systems.

- Completion of outstanding State Disaster Plans and enhancement of existing plans to include consideration of tsunami.
- Use existing tsunami hazard studies that have been completed for the Southwest Pacific Nations, historical records, Geographic Information System (GIS) data and deep ocean models to identify low-lying communities which may be prone to tsunami impacts from all likely tsunami sources.

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

Contingent on the availability of human and financial resources, the Australian Bureau of Meteorology (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 Palau'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 Palau'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' which are achievable with very few additional resources.

Table 1: Priority ranking and resource intensity scale

PRIORITY	RESOURCE INTENSITY
Very High	Low – Recommendation currently being progressed or could possibly be progressed within the capacity of existing in-country resources (funds and staff).
High	Medium – 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.
Medium	High – Recommendation would require a high level of additional staff and/or expertise and funds. External funding support is likely to be required.
Low	Very High – 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 Palau's tsunami warning and mitigation system.

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	Approve, adopt and implement the draft Palau NDRMF (D2) and progress towards incorporating this framework into legislation.	Low	Governance & Coordination	Multi-hazard	1
Very High	That the full authority and responsibility for analysing and interpreting tsunami messages, tsunami data, and sending out tsunami warnings for Palau is formally delegated to the Palau NWS Office. Warning procedures must be pre-agreed and approved by key government stakeholders and include a tsunami warning decision making matrix that outlines what action will be taken for each international tsunami message received by Palau.	Low	Tsunami Warnings	Tsunami specific	14
Very High	Enhance the NEC to ensure a multi-stakeholder forum exists to address DRM in a multi-hazard context. This should include all-hazard Working Groups for different aspects of DRM (for example, prevention, response). Ensure these Working Groups incorporate State and Village representatives, the private sector and other key stakeholders.	Low	Governance & Coordination	Multi-hazard	5
Very High	Each agency and organisation complete a multi-hazard DRM plan which considers tsunami (fast onset hazards) in line with their responsibilities outlined in the National Disaster Plan (1998, D1) and revised NDRMF when approved (D2). Complete in a standard format, in consultation with relevant stakeholders and share when completed.	Medium	Governance & Coordination	Multi-hazard	2

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	On formal approval of the NDRMF develop a Palau National Tsunami Response Sub-Plan to clearly articulate PPRR for tsunami on a national level including mitigation, warning, response and regular testing of the system.	Medium	Governance & Coordination	Tsunami specific	3
Very High	NEMO, NWS, Palau Community College (PCC) and Office of the Palau Automated Land And Information System (PALARIS) work cooperatively with assistance from external technical agencies (such as SOPAC, PTWC, JMA, the Bureau, University of Hawaii and Guam etc.) to develop in-country scientific skills and knowledge of tsunami, other hazards and tools to improve in-country interpretation of international tsunami messages.	Medium (depending on action taken)	Research Expertise	Tsunami specific	10

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	Develop, approve, share and maintain national tsunami warning and response SOPs for each agency involved in the tsunami warning and response process. In particular, for tsunami warnings, these procedures should include: a. A comprehensive decision-making process (flow diagram) for the receipt and dissemination of tsunami warnings. b. Procedures for what action will be taken in Palau for each type of international tsunami message received from PTWC and others; c. Warning templates including “No Tsunami Threat” bulletins, Palau tsunami warnings and cancellations. Such templates must include pre-agreed and approved emergency response action statements to advise the public in affected areas on the action to be taken; d. Agreed and regularly maintained distribution lists; e. Use of available scientific information (deep ocean tsunami models, coastal and deep ocean sea level data, travel time software) to localise the tsunami threat to Palau. As the warning system matures, progressively move towards developing criteria for identify differing levels of tsunami threat (for example, marine currents only) as well as cancelling a Palau tsunami threat; f. A process for issuing tsunami warnings to marine vessels and ports; and g. Procedures to carry out regular and ongoing system tests. Consideration of system redundancies, such as a second back-up agency in-country to receive the international tsunami messages	Medium	Tsunami Warnings	Tsunami specific	15
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Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	Investigate use of a 'Chatty Beetle' or Rural Internet Connectivity System (RICS) solution as a backup to EMWIN and the PNCC circuits to receive emergency warnings at the critical NWS Office portal in near future. Regular use of systems such as the 'Chatty Beetle' for weather observations ensures community skills are kept current.	Medium	Communications	Multi-hazard	16
Very High	A 24/7 communication link to the remote Southwest Islands is established to disseminate emergency warnings. Recommend 'Chatty Beetle' or solar charged, permanently mounted Iridium handhelds in the MoH Emergency room and/or at the 911 call centre at the Koror Public Safety Office.	Medium	Communications	Multi-hazard	18
Very High	Completion of outstanding State Disaster Plans and enhancement of existing plans to include consideration of tsunami, evacuation for tsunami, formalisation of State Emergency Operations Centres (EOCs) and traditional emergency response mechanisms (for example, the role of Chiefs).	Medium	Tsunami Emergency Response (including evacuation)	Tsunami specific	24
Very High	Use existing tsunami hazard studies that have been completed for the Southwest Pacific Nations, historical records, GIS data and deep ocean models to identify low-lying communities which may be prone to tsunami impacts from all likely tsunami sources. Commence tsunami mitigation, response and evacuation planning using local knowledge.	Medium	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	29

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Very High	All agencies with key roles to play in the tsunami warning and mitigation systems are adequately resourced to carry out their nominated functions under the National Disaster Plan (1998, D1) (and revised framework when approved, D2). In particular, enhancement of NEMO human resources should be considered to allow them to meet their responsibilities.	High	Governance & Coordination	Multi-hazard	6
High	Nationalise international tsunami warnings through the NWS office obtaining access to the data from sea level gauges (coastal and deep ocean) in the region in real-time including training for staff on how to interpret this data and feed this data into operational tsunami SOPs. An immediate short term solution would be to access data via existing web links (The University of Hawaii http://uhslc.soest.hawaii.edu/ or IOC http://www.vliz.be/gauges/). Access to and training in the use of Tide Tool (PTWC developed) should be considered.	Low (internet) to Medium (training needs)	Tsunami Monitoring	Multi-hazard (data can be used for other applications)	12
High	NEMO, NWS Office, Koror Public safety 911 centre or the Ministry of Health (MoH) emergency room have interface hardware and software installed to send emergency cellular text and Emergency Alert System (EAS) Television (TV) text to disseminate warnings.	Low	Communications	Multi-hazard	17
High	During a natural disaster emergency services may be isolated from parts of the Koror community due to loss of causeways or bridges. It is recommended Koror State Government continue to consider options for mitigating this risk, these may include back-up locations or multi-skilling of emergency services staff.	Low (to High for implementation of strategies)	Tsunami Emergency Response (including evacuation)	Multi-hazard	27

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	The hospital at Koror is currently vulnerable to a number of natural disaster threats, including tsunami, due to the proximity to the sea, the low-lying nature of the site and the potential for isolation from the rest of the Palau population (damage to causeways). Early stages of planning for a new hospital are progressing. Implementation of these plans is strongly encouraged from a multi-hazard perspective.	Low (to Very High for implementation of actual relocations)	Tsunami Emergency Response (including evacuation)	Multi-hazard	28
High	Incorporate tsunami warning and mitigation into State Disaster Risk Management Planning (either in existing plans or as a hazard specific Sub-Plan) and include planning for Village preparedness and response.	Medium	Governance & Coordination	Tsunami specific	4
High	Review and strengthen the requirements for marine users to have adequate radio communications on boats to ensure effective receipt of tsunami and other hazard warnings. Ensure the upgrade and maintenance of radio systems on Police search and rescue boats.	Medium	Communications	Multi-hazard	22
High	Consideration should be given to development of emergency evacuation zones for tsunami and review of the placement of existing community emergency shelters for their community to ensure safety away from low-lying coastal areas (particularly for the low-lying southern States (for example, Tobi and Sonsorol). Evacuation authority should be incorporated into the revised NDRMF and associated legislation and tsunami evacuation plans incorporated into the Palau Tsunami Sub-Plan and State Plans.	Medium	Tsunami Emergency Response (including evacuation)	Tsunami specific	23

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	Bureau of Land and Survey with PALARIS complete an inventory of the geospatial data available for tsunami and multi-hazard risk assessments and mapping of populated centres. In addition to low-lying residential and tourist areas this study needs to plot: a. Vulnerable infrastructure including schools, hospital, dispensaries (considering the infirmed and elderly); b. Critical services including power, water, sewerage and communications; and c. Industrial infrastructure and services including oil storage and chemical manufacture and storage.	Medium	Tsunami Hazard, Vulnerability, Risk and Mitigation	Multi-hazard	30

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	Key Government agencies and NGOs work together to continue to build on the current DRM community awareness programs incorporating tsunami into the multi-hazard program that includes: a. A focus on communities at risk where possible; b. Agreement on key tsunami education messages for incorporation into all programs (for example, National Science Week); c. Continue with the integration of tsunami (and multi-hazard) information into the school curriculum; d. Look at opportunities to deliver educational messages about tsunami across a range of mediums (for example, electronic media, brochures and face to face delivery); e. Further develop networks with international agencies such as the International Tsunami Information Centre (ITIC) and SOPAC regarding using/adapting existing international materials about tsunami and other hazards; f. Review and evaluate awareness programs (through focus group testing, questionnaires etc.) to ensure effectiveness of dissemination of information; g. Educate the community about how they will receive warning information and what to do; h. Ensure a process is designed and employed to educate the tourism industry about key tsunami messages and what to do in the event of a tsunami. The tourism industry can then employ an education process for divers and other visitors;	Medium	Knowledge, Information, Public and Stakeholder Awareness and Education	Tsunami specific	32

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	Recommendation 32 (Continued) i. Awareness about tsunami and other hazards be incorporated into certification and training of marine boat operators, including tour operators; and j. Identify and employ methodologies to cater for special needs and non-English speaking groups.	Medium	Knowledge, Information, Public and Stakeholder Awareness and Education	Tsunami specific	32 (Continued)
High	Completion of training needs analysis and development of a national training framework for DRM in Palau (including a training database to track progress). Development of tsunami modelling capability at PALARIS could form part of the identified training needs.	Medium	Knowledge, Information, Public and Stakeholder Awareness and Education	Multi-hazard	35
High	Development of a tsunami competency-based training program for the operational staff of key agencies (NEMO and NWS) to reflect tsunami operational practices as outlined in developed SOPs.	Medium	Knowledge, Information, Public and Stakeholder Awareness and Education	Tsunami specific	36
High	Palau should seek technical assistance to upgrade and maintain the Amplitude Modulated (AM) broadcast station. AM radio signals can deliver disaster related warnings and updates to the Southwest Islands and the northern populations that are out of Frequency Modulated (FM) broadcast station range. Consideration should also be given to the remote trigger of a siren signal to the radio station.	High	Communications	Multi-hazard	19
High	Add Radio Frequency (RF) or cellular triggered (with manual back up) sirens in all States.	High	Communications	Multi-hazard	21

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	Train remote island communities to be 'primary responders' (for example, island leaders) to disasters before help arrives. This should include maintenance and use of communications equipment.	High	Knowledge, Information, Public and Stakeholder Awareness and Education	Multi-hazard	37
High	Maintain and upgrade the central and north medical Very High Frequency (VHF) two-way radio network as well as the VHF in the Rock Islands. Consider upgrading to a linked repeater system with full interagency interoperability.	Very High	Communications	Multi-hazard	20
Medium	Key Government agencies work together on a media education and communication strategy that assists the media to understand hazards and warning procedures, forms agreement on approved media platforms for warning the community (for example, all radio stations) and develop templates for providing information to the media in a real event.	Low	Knowledge, Information, Public and Stakeholder Awareness and Education	Multi-hazard	33
Medium	Regularly test the tsunami warning system by conducting multi-agency exercises (including testing of emergency communication arrangements between key agencies). Complete post exercise lessons learned processes to guide SOP changes and staff training.	Medium	Tsunami Emergency Response (including evacuation)	Tsunami specific	26
Medium	NEMO progresses towards employing a national Public Information Officer to coordinate media liaison and monitoring before, during and after emergency events, lead community awareness programs and transfer information and skills from international and regional partners to benefit DRM in Palau.	Medium	Knowledge, Information, Public and Stakeholder Awareness and Education	Multi-hazard	34

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Medium	Regular communication with near neighbours (for example, the Federated States of Micronesia (FSM), Papua New Guinea (PNG)) both at an operational and planning level will assist all involved to develop capacity to manage and respond to a range of natural hazards. This can be facilitated through involvement in forums such as the Pacific Platform for DRM.	Medium	Regional & International Coordination	Multi-hazard	7
Medium	Participate in the Southwest Pacific Tsunami Working Group of the Intergovernmental Coordination Group Pacific Tsunami Warning and Mitigation System (ICG PTWS) by nominating a representative of Palau to be on this working group. Use this group to learn about regional initiatives and initiatives of other Pacific Island Countries (PICs) with regard to tsunami warning and mitigation systems in small island nations.	Medium	Regional & International Coordination	Tsunami specific	8
Medium	Investigate gaining access to a deep ocean tsunami model scenario database and the ComMIT community model for tsunami inundation (including appropriate training) to enable further determination of more specific threat information for Palau.	High	Research Expertise	Tsunami specific	11
Medium	Develop an information management system (database) to act as a central depository to ensure data available in-country, that may be useful for responding to a disaster, is available for real-time response. This data can also be used for preparedness planning (for example, mapping critical infrastructure).	High	Tsunami Emergency Response (including evacuation)	Multi-hazard	25

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
Medium	That Palau (NWS, NEMO with PALARIS and Office for Environmental Response and Coordination (OERC)) with external technical assistance, consider installing a sea level gauge network throughout Palau. This data would provide a better understanding of tsunami and improve reliability of inundation estimations. The data would also have multi-hazard and day to day uses.	Very High	Tsunami Monitoring	Multi-hazard (data can be used for other applications)	13
Medium	Acquire the necessary baseline data for populated areas to fill identified gaps as part of a multi-hazard (storm surge, tsunami, climate change) mapping activity using high resolution data collection methods such as Light Detection and Ranging (LiDAR).	Very High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Multi-hazard	31
Low	Become a member of the Intergovernmental Oceanographic Commission (IOC) to ensure Palau has a voice in determining IOC programmes and activities of benefit nationally as well as benefiting from IOC capacity building in marine science.	Low	Regional & International Coordination	Multi-hazard	9



Section

2

2. Project Background

2. Project Background

2.1. About the Project

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

2.2. Broad Project Aim

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

2.3. Key Project Output

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

2.4. Project Methodology

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

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

The questionnaire for the PICs is a modified version of that used for the Indian Ocean equivalent project. The Indian Ocean questionnaire was jointly developed by UNESCO/IOC, SOPAC, the World Meteorological Organisation (WMO) and the International Strategy for Disaster Reduction (ISDR). Details of the Indian Ocean equivalent project can be found at <http://www.ioc-tsunami.org/content/view/275/978/>

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

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

2.6. Tsunami warnings in the Pacific

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

2.7. International Tsunami Forums

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

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

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

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



Section

3

3. Country Background and the Tsunami Threat

3. Country Background and the Tsunami Threat

3.1. About Palau

The democratic Republic of Palau (referred to as Palau throughout this report) is an independent country in a Compact of Free Association with the USA which runs for 50 years from 1994 to 2044 (DFAT, 2009). A Micronesian country, it lies to the east of the Philippines. The country has a land surface area of 176.84 square miles (458 square km) and a population of 20,279 (2008) (DFAT, 2009). The country has an exclusive economic zone extending over 237,850 square miles (616 028 square kilometres) (Presentation, Ms Dilwei Maria Ngemaes). Only nine of Palau's 340 islands are inhabited. Most of the islands are volcanic origin and others are raised limestone (Presentation, Ms Dilwei Maria Ngemaes). The main languages are Palauan and English and the currency is United States Dollar. Palau is a member of the United Nations and Pacific Island Forum.

The President of Palau, Johnson Toribiong, is both Head of State and Head of Government (DFAT, 2009). Presidential elections to select the president and the Vice President take place every four years, at the same time as the United States' presidential election. President Toribiong won office at elections on 4 November 2008 and was inaugurated on 15 January 2009 (DFAT, 2009). Kerai Mariur is Palau's Vice President. The Palau National Congress (Olbiil era Kelulau) has two houses. The Senate has nine members elected nationwide. The House of Delegates has 16 members, one each from Palau's 16 states. All of the legislators serve four year terms. Each state also elects its own governor and legislature. The Council of Chiefs is an advisory body to the president containing the highest traditional chiefs from each of the 16 states. The Council is consulted on matters concerning traditional laws and customs (DFAT, 2009).

Palau has one of the highest standards of living of the PICs and an economy with good potential for sustained growth (DFAT, 2009). Palau's commitment to conservation of its unique and pristine marine environment means tourism is geared towards a low volume but high-yield. The service sector dominates the Palauan economy, contributing more than 80 per cent of Gross Domestic Product and employing around 50 percent of the population. The Government employs roughly 15 percent of the population (DFAT, 2009).

Palau's Compact of Free Association with the USA provided \$US47 million in assistance over the compact's first 15 years until 2009 (DFAT, 2009). At the time this Report was written, discussions between Palau and the USA were underway to review the Compact and assistance arrangements. A trust fund has been set up, and some of the Compact funding assistance has been set aside to be used after grants cease. Many major projects around Palau have been funded by the Compact including the recent construction of a road around Babeldaob, Palau's largest island. The Compact also provides for some USA federal programs to continue after grants cease until the end of the Compact in 2044. These include air safety, weather prediction, health services, defence and assistance in the event of natural disasters (DFAT, 2009). The main economic challenge confronting Palau is to ensure the long-term viability of its economy by reducing its reliance on foreign assistance.

Palau is vulnerable to a number of natural and human induced hazards (D2). Due to the small geographical area and small population of Palau, such events can have a devastating economic impact on the country (D2). Over the past forty years, Palau has experienced a number of disasters including typhoons/tropical storms, drought, climate change and the collapse of the Koror-Babeldaob Bridge on which delivery of key utilities relied (D2).

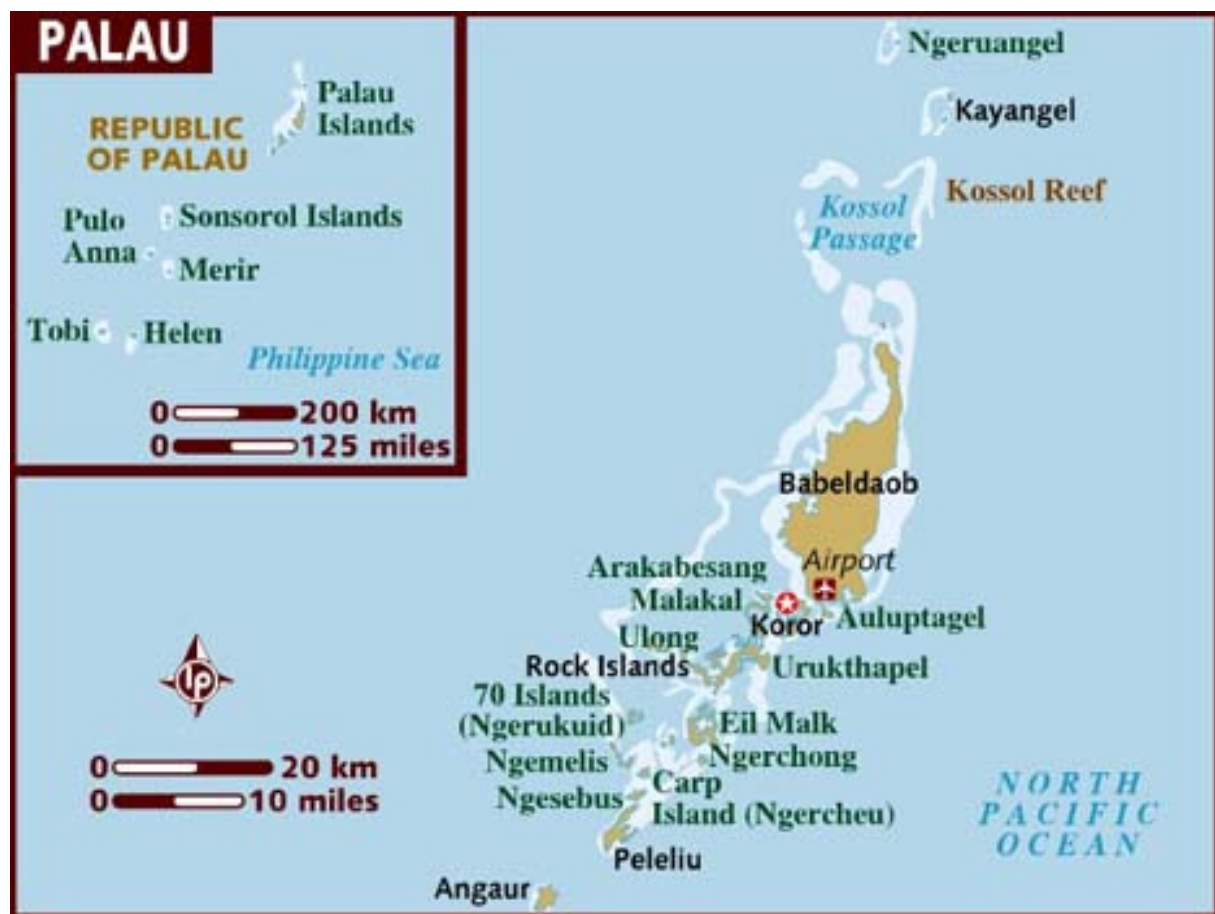


Figure 1: The Republic of Palau (Source: The Lonely Planet)

3.2. Tsunami Threat Sources and Tsunami History in Palau

An overview of potential tsunami threat sources and tsunami history in Palau 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 Palau. Such a study is outside the scope of this project.

Palau's draft Palau NDRMF (D2) lists tsunami as a low level risk under the natural hazards profile. A number of small tsunami events (generally less than 10 cm in amplitude) have been recorded in the past on Palau's third party sea level gauges at Pohnpei, Malakal and Yap. An example of one such event is included in Figure 2c which shows two small tsunami (<10cm amplitude) recorded on 3rd January 2009 at Yap. This event was generated by two earthquakes Moment Magnitude (Mw) 7.6 and 7.5 on the New Guinea trench. Since 1970, there are records of eight tsunami that have reached Palau, although no devastation has been observed (Presentation, Dr Jane Warne).

Thomas, Burbidge and Cummins (2007) completed *A Preliminary Study into the Tsunami Hazard faced by Southwest Pacific Nations*. Scenarios for an Mw 8.5 and Mw 9.0 earthquakes were used to investigate normalised offshore (to a notional depth of 50 metres) wave amplitudes for tsunami caused by earthquakes along subduction zones (Refer Figure 2). In this study, Palau's maximum amplitude for all tide gauges for all Mw 9 tsunami was 240cm with the most significant source regions being the Philippines, Marianas, Ryukyu, Nankai and New Guinea trenches (amplitude greater than 75cm at 50m depth or single most significant source region if no amplitude exceeds 75cm). For a Mw 8.5 tsunami the maximum amplitude reduced to 130cm with the Philippines and New Guinea trenches being the most significant source region. Although these values are less than many of the southwest PICs, it is not possible to assert that tsunami of these amplitudes are not of concern without a more detailed study involving inundation modelling (Thomas, Burbidge & Cummins, 2007).

A further study completed by Thomas and Burbidge (2009) 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, for a 2000 year return period maximum amplitude of between 2.3 to 2.7 metres could be expected near Tobi, Fanna and Sonsorol and to 3.5 metres for some model output points on the west coast of Babeldaob and Koror. At this return period the hazard originates almost exclusively from the Philippines Trench and a small contribution from the New Guinea trench. At a return period of 100 years the maximum amplitudes near Tobi, Fanna and Sonsorol are approximately 0.3 metres (Thomas & Burbidge, 2009), increasing to 0.5 metres on the western coast of Babeldaob.

The GA studies are supported by investigation of the Bureau's deep ocean model-based tsunami prediction system (refer to Figure 3). Tsunami travel times from the New Guinea trench are short (less than one to two hours) and the Philippines trench (approximately one hour). Long distance sources including the Kuril Islands, Russia, Alaska and South America can also impact on Palau with travel times of approximately 6 hours from the Kuril trench to greater than 10 hours from South America. A significant warning window exists for tsunami generated by these more remote sources.

Palau currently receives tsunami warnings from the PTWC. Within their multi-hazard framework, the country will need to plan for tsunami warnings and events, with particular consideration of low-lying islands. Palau needs to be aware that short warning times from these nearby sources (of 1 to 1.5 hours) translate to only 30 to 50 minutes of time to warn the community to take appropriate action in the event of a tsunami.

The land mass of Palau sits atop the bathymetric feature commonly known as the Palau-Kyushu Ridge which extends south of Palau to many hundreds of kilometres to the north (Palau, 2009). In general the geomorphologic structure of Palau is not conducive to severe impacts from tsunami, particularly the northern states. The steep oceanic walls and barrier reefs potentially provide some protection from tsunami impacts. However, there are some specific considerations that should be noted. Geographically the southern states are isolated and relatively low-lying. This makes impacts from a tsunami more likely than in the larger northern islands, and the ability to provide assistance more limited. Low-lying farming land has been flooded during king tides in the past. Economically Palau is highly dependent on tourism for its trade balance. In addition to Palau's coastal way of life, much of this tourism relates to water activities such as diving and snorkelling. Typically, significant currents are associated with tsunami, even for small events. Local currents may be two or three times greater than those experienced under normal conditions. This should be taken into consideration when assessing the risk of small events to marine activities. People in the water during a tsunami are at significant risk due to associated high currents event with small tsunami.

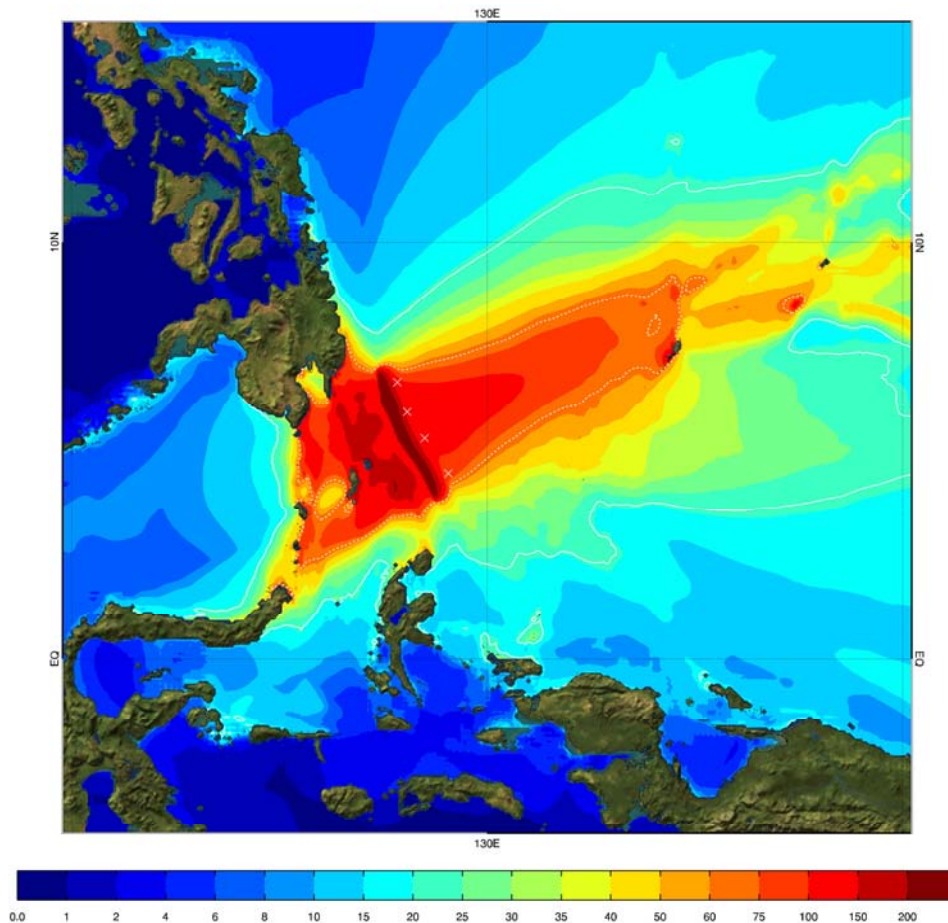


Figure 2a: Maximum amplitude tsunami from Mw 8.5 earthquake scenario on the Philippines trench showing tsunami energy beamed towards Palau (Source: Scenario 122c of MOST model from T2 database, Greenslade, Simanjuntak and Allen, 2009).

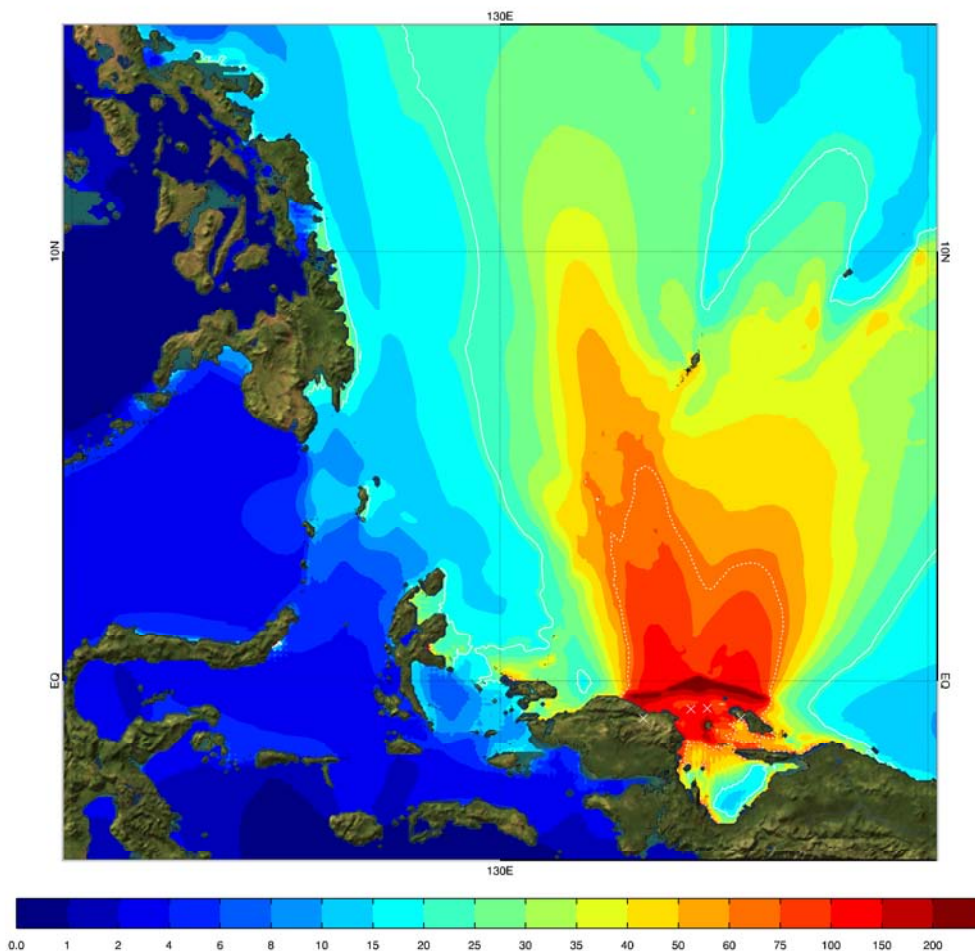


Figure 2b: Maximum amplitude tsunami from Mw 8.5 earthquake scenario on the New Guinea trench showing tsunami energy beamed towards Palau (Source: Scenario 132c of MOST model from T2 database, Greenslade, Simanjuntak and Allen, 2009).

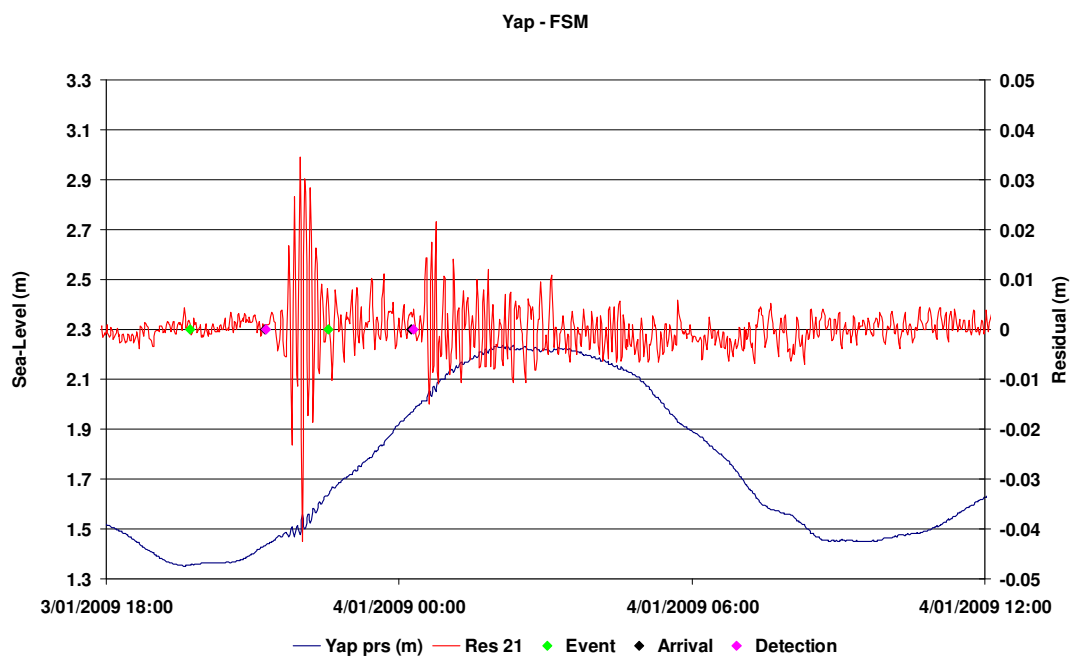


Figure 2c: 3 Jan 2009, two small (<10cm amplitude) events at 19:42 (Mw 7.7) and 22:33 (Mw 7.5) event from the New Guinea trench as detected at Yap by the University of Hawaii sea level gauge



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



Figure 3b: The location of Palau and other Pacific Island Countries in relation to regional and local subduction zones (in orange)



Section

4

4. The Palau Tsunami Capacity Assessment

4. The Palau Tsunami Capacity Assessment

4.1. Date and Location

The tsunami capacity assessment of the ability of Palau to receive, communicate and effectively respond to tsunami warnings took place from 11 to 14 August 2009, at the Koror State Assembly Hall in Koror, Palau.

4.2. Visiting Assessment Team and Participants

The Visiting Assessment Team was made up of those outlined in Annexure 2. The focal point in Palau for the organisation of the workshop and completion of this project was Mr Alonzo Kyota, Coordinator, Palau NEMO and the staff of NEMO. A full list of workshop participants can be found in Annexure 1.

4.3. Workshop Summary

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

4.3.1. *Day 1 (11 August 2009)*

Day one of the Palau Tsunami Capacity Assessment workshop was attended by 47 participants.

The opening session was chaired by Mr Alonzo Kyota. The workshop was officially opened by Mr Issac Soaladaob (Chief of Staff of the Presidents Office and Vice Chairman of the National Emergency Committee). Mr Soaladaob commented that although the last tsunami event in Palau cannot be remembered, a tsunami will strike Palau's shores in the future. He urged participants to be actively involved in the workshop and make the most of the opportunity. A response to the Chief of Staff's address was given by Visiting Tsunami Capacity Assessment Team Leader Cherie O'Brien (Project Manager, Bureau). Ms O'Brien outlined the complexities of developing an end-to-end tsunami warning and mitigation system. She outlined the challenges faced in preparing for tsunami, a less prevalent but potentially highly destructive hazard. Ms O'Brien reiterated that a multi-hazard approach was needed and that the workshop aim was to develop a comprehensive way forward for Palau's tsunami warning and mitigation system.

Ms O'Brien then went on to introduce the Tsunami Capacity Assessment project and process. Dr Jane Warne from the Visiting Assessment Team then presented on the science of tsunami and the tsunami threat to Palau. Dr Warne demonstrated the possible sources that have the potential to generate tsunami and impact upon Palau with the Philippines trench posing the largest threat. Since 1970, there are records of eight tsunami that have reached Palau, although no devastation has been observed. Discussions focused around tsunami causing possible marine threats to divers and fuel unloading etcetera due to dangerous currents. Ms Maylene Joshua (Administration Specialist, NEMO) presented to the workshop on the NEMO tsunami response procedures, explaining how information is relayed to NEMO by the NWS and on-forwarded to the community.

A focus group session was successful in identifying Palau's priorities for improved tsunami warning and mitigation system. The workshop then commenced answering the tsunami capacity assessment Questionnaire in session.

4.3.2. Day 2 (12 August 2009)

Day two of the Palau Tsunami Capacity Assessment workshop was attended by around 36 participants.

Ms Dilwei Maria Ngemaes presented to the workshop on the Palau NWS. The presentation included the Meteorological and Climatological characteristics of Palau as well as details of the NWS forecast, data acquisition, aviation, climate and warnings programs. Ms Ngemes also completed a presentation on the planned relocation of the NWS office to the Palau International Airport, a project funded by NOAA to ensure ongoing quality of data measurements after the recent construction of a two story building adjacent to the current NWS compromised this.

Presentations were then made by Mr Ross Bunn on the components of a tsunami warning system and Mr Bruce Best on communications for tsunami warnings. Mr Bunn highlighted various sources of information for tsunami warning purposes, including PTWC and JMA. Mr Bunn explained that these centres cover responsibility for different geographical areas and used varying criteria to issue tsunami warnings. As an example, Mr Bunn demonstrated the warning thresholds used by the Joint Australian Tsunami Warning Centre (JATWC). Mr Bunn also highlighted the requirement for SOPs and competency based skills training for staff involved in issuing tsunami warnings. In his presentation, Mr Best reiterated that a key challenge for Palau is to provide warnings and post event support to outer island communities. Mr Best reviewed the options and challenges for the three key areas of communications for a tsunami warning system including detection and monitoring, receipt of international warnings and dissemination of warnings to the community including a review of current and possible future technologies.

Throughout the remainder of the morning session the Tsunami Capacity Assessment Questionnaire for Palau was worked through in session. The Visiting Assessment Team then visited a number of locations to gain a further understanding of Palau's abilities and challenges with regard to tsunami warning and mitigation. These locations include the PNCC, the Palau Patrol Boat and the Belau National Hospital.

4.3.3. Day 3 (13 August 2009)

Day three of the Palau Tsunami Capacity Assessment workshop was attended by 31 participants. Ms Terri Reid from the Visiting Assessment Team presented on Emergency Coordination, Planning and Community Awareness on the morning of the third day. Ms Reid's presentation focussed on an all-hazard, all-agency approach which covers prevention, preparedness, response and recovery. Ms Reid discussed exercising plans, capacity development programs for emergency managers and community preparedness. Ms Reid highlighted the importance of education about tsunami, teaching consistent key messages, using and/or adapting existing tsunami materials in the Pacific region and testing/evaluating/reviewing effectiveness of this education)preparedness.

The remainder of the Tsunami Capacity Assessment Questionnaire for Palau was then worked through in session. Visits were also made to the Palau Red Cross and PALARIS in the afternoon. A reception was held in the evening of the third day, attended by the Visiting Assessment Team and in-country workshop participants.

4.3.4. Day 4 (14 August 2009)

Day four of the Palau Tsunami Capacity Assessment workshop participants gathered to review the preliminary recommendations for enhancement of the country's tsunami warning and mitigation system. The workshop was jointly closed by Ms Cherie O'Brien and Mr Alonzo Kyota.

4.3.5. Additional Visits

The Tsunami Assessment Team also made visits to the University of Hawaii tide gauge at Malakal, Koror Harbour, NWS, NEMO, PCC, the Red Cross and the Ministry of Education (MoE). These visits greatly increased the teams understanding of the capabilities of Palau's tsunami

warning and mitigation system. Findings from these and other visits were fed into the recommendations for system improvement.

4.4. Workshop Photos (Koror, Palau August 2009)



Palau Tsunami Capacity Assessment Workshop participants with Mr Issac Soaladaob (Chief of Staff of the Presidents Office and Vice Chairman of the National Emergency Committee)



Workshop Participants convene at the Koror State Assembly Hall



Visit conducted to PNCC



Visit conducted to the Palau Patrol Boat

Workshop Photos (Continued)



Visit conducted to the University of Hawaii sea level gauge at Malakal, Koror Harbour



Visit to the Belau National Hospital. In this photo - the hospitals Emergency Operations Centre



The workshop reception was held on the Thursday evening



The Palau NEMO and current Emergency Operations Centre (Koror)



Mr Alonzo Kyota, Coordinator, Palau NEMO addresses the workshop



Palau's famous Rock Islands



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 4 in which the status of key components of Palau's tsunami warning and mitigation system are outlined (as at the date the Tsunami Capacity Assessment Workshop was held in August 2009. Updates between then and the publication of this report are as marked).

Table 4: Summary of current status of key components of Palau's tsunami warning and mitigation system as at August 2009.

Rating

Yes - fully realised
Partially realised
No - not realised

Key Component	Rating	Comment
Authority, Coordination and NGO Role		
Legislation in place for tsunami warnings and response	No	A National Disaster Plan (1998, D1) exists and is in the final stages of being reviewed (draft NDRMF (D2)). The current 1998 plan is legislated by Executive Order No. 166-99. However, tsunami warning roles and responsibilities are not clearly articulated in the 1998 plan and therefore not legislated.
Tsunami coordination committee or effort at a National and local level	No	There is a national governance structure consisting of the Crisis Leadership Team (CLT) comprised of the President and Cabinet, NEC of 22 members including State Governors the Vice President as Chair and Chief of Staff as Vice Chair, the National Emergency Operations Centre (NEOC), and Incident Command Post (ICP) (a tactical location near the incident) to manage response during an event. The NEC could benefit from meeting regularly outside of disaster events and incorporating mitigation and preparedness through the development of active Working Groups under this structure.
Agency responsibilities clearly defined	Partially	DRM Plans exist in Palau at a National (refer to 5.3.1) and State Government level (for example, Kayangel State Government, State Disaster Plan (D29)). A tsunami response, evacuation and recovery plan does not exist

Key Component	Rating	Comment
NGOs and Red Cross Society have a defined role in tsunami warning dissemination, preparedness and awareness and emergency response	Partially	Engagement of NGOs is primarily in emergency response and recovery and community awareness (for example Cardio Pulmonary Resuscitation (CPR) training). These include the Red Cross, traditional State level men, women and youth groups, religious groups, the Belau Tourism Association and multicultural community clubs (such as the Filipino Community in Palau Group).
International and Regional Cooperation		
Country represented at an international and regional level to aid cooperation in tsunami warning and mitigation efforts	Partially	Strong linkages with international agencies and donors to assist in DRM, including technical assistance and emergency response. These include SOPAC, South Pacific Regional Environmental Programme (SPREP), Pacific Island Forum (PIF), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), PTWC, Comprehensive (Nuclear) Test Ban Treaty Organisation (CTBTO), International Federation of Red Cross and Red Crescent Societies (IFRC), United Nations Development Programme (UNDP), International missions and aid agencies and various USA agencies. Could benefit from further involvement in international tsunami forums and the IOC.
Priorities		
Priorities established for implementation of tsunami warning and mitigation system at a National level	Yes (through this process)	Not specifically completed for tsunami, except through the Tsunami Capacity Assessment Workshop in August 2009. See below the priorities identified during this process. - Emergency Response Planning - Enhancement of National tsunami planning. - Plans at the community level, particularly for small flat islands such as Tobi. - Identify evacuation requirements. - Drills and exercises (preceded by education). - Community Awareness - A public education program is needed similar to that run for typhoons. - Focused awareness training for specific groups and special interest groups (such as non-English speaking).

Key Component	Rating	Comment
Priorities (Continued...)		
<i>Continued...</i> Priorities established for implementation of tsunami warning and mitigation system at a National level	<i>Continued...</i> Yes (through this process)	• Risk Assessment & Warning Dissemination ○ Development of a better understanding of the tsunami risk. ○ Identify low-lying coastal areas, public and tourist areas and areas with key utilities, essential services and industry. ○ Install more bull horns for warning. ○ Radio and TV for dissemination of warning information. ○ Informing Governors to pass the information onto the community. ○ Use of the emergency service networks and communications channels. • Interagency Cooperation ○ Further coordination for receipt and dissemination of tsunami warnings, public education and evacuation. ○ Activating agencies required.
Multi-hazard Approach		
Tsunami warning capabilities are being established within a multi-hazard framework	Yes	Palau is working within a multi-hazard framework for DRM. This will be enhanced further after the adoption of the draft NDRMF (D2) and associated legislation as well as the DRM National Action Planning process due to begin in 2010-12.
Research Expertise		
Active research is being undertaken within the country for seismology and tsunami to strengthen the tsunami warning and mitigation system	No	There is no research into tsunami being undertaken in Palau. There is a limited research skill base in Palau to support analysis and preparedness at a technical level in country (for example, PALARIS appears to have good skill in Information Technology (IT), GIS and capacity to undertake modelling application work). Some cooperation with external technical (regional and international) agencies currently exists and could be further enhanced. Scientific research capability exists with in-country organisations such as the Coral Reef Research Foundation, and Palau International Coral Reef Center. These are not tsunami related at present.
Tsunami monitoring infrastructure		
Existence of seismograph stations and integration of real-time data from these stations into the tsunami warning process	Partially	There is one seismic station at PCC in Koror. The station is part of the JMASTEC network. PCC has access to the seismic data collected on site and eight PCC employees have been trained to use the instrumentation. Operational agencies do not have access to the seismic data in real-time for operational use.

Key Component	Rating	Comment
Tsunami monitoring infrastructure (Continued...)		
Existence of sea level stations and integration of real-time data from these stations into the tsunami warning process	Partially	There is one sea level gauge at Malakal, Koror Harbour. This is owned and maintained by the University of Hawaii and first in maintenance support is provided by the NWS.
Sharing of seismic and sea level data internationally to facilitate improvement of PTWC tsunami messages for the region	Partially	The one sea level gauge at Malakal, Koror Harbour transmits data via satellite to University of Hawaii and internationally on the GTS. The one seismic station at PCC in Koror distributes the data is distributed internationally for inclusion in seismic evaluation.
Warnings		
Nation receives PTWC messages	Yes	NWS receives international tsunami messages (PTWC, JMA, ATWC (Alaska)) through e-mail, fax, EMWIN and AISR with audio alert through internet via PNCC links.
24/7 operational staff at warning receipt and dissemination location	Yes	NWS operates 24/7 and has support from on-call staff.
Disseminate national tsunami warnings as guided by a Standard Operating Procedure	Partially	Procedures currently exist for dissemination of tsunami warnings nationally. However, the process from receiving the international tsunami message to issuing advice to the community is too lengthy and convoluted to effectively warn the Palauan public. Currently, national warnings are issued by NEMO (who are not 24/7), after receiving advice from the NWS. NEMO's actions must first be approved by the NEC Chairman or deputy. Dissemination mechanisms to the community require improvement.
System redundancies in place for receipt of PTWC messages and dissemination of National warnings	Partially	NWS has multiple paths for incoming PTWC alerts via the PNCC Intelsat supplied Internet or phone/fax lines with Iridium backup and EMWIN backup. A second 24/7 agency does not receive tsunami messages at present. There is currently no back-up agency identified to disseminate tsunami warnings if the NEMO is unable to do so.

Key Component	Rating	Comment
Warnings (Continued...)		
Redundant 24/7 methods available for dissemination of warnings to community (for example, public radio, sirens)	Partially	Mechanisms that would currently be used to disseminate tsunami warnings include: • Activating the Koror emergency siren (slow wailing alert tone three to five minutes). • Contacting the following by phone: ○ The most vulnerable State first and other States. ○ Hotels on the coastline. ○ Bureau of Education (and schools if during the day). ○ Prepare official warning to radio stations. ○ Police. • Koror Police Office to Southwest Islands (HF or Iridium). • Remote northern areas via Police car top siren, bull horn or church bells through State Governors. • Resorts which have their own alarms, public address systems and procedures. • Media – radio and television. Current problems include: • Radio stations are manned from 6am to 12 midnight, and are pre-recorded over night. The station manager is available for emergency call-outs. • Palau is not currently using the EAS or SMS to disseminate warnings. EAS is in store at the Balau National Hospital. • Siren limited to Koror at present. • Bullhorns are limited (on 3 Police cars on the north island to cover 10 northern States). • Marine users (boats etc.) require adequate communications to receive tsunami and other warnings. (Refer below for remote communities)
Effective warning dissemination to remote communities	Partially	Island communication systems are not 24/7 to receive messages. None of the three broadcast stations dependably cover the southwest islands or all the villages in the north. A 24/7 communication link to the remote Southwest Islands is required to disseminate emergency warnings (for example, Chatty Beetle). Update March 2010: Small Ku Band dishes have been installed in the Southwest. Training and configuration of systems required.

Key Component	Rating	Comment
Warnings (Continued...)		
Communications coverage of whole country that is effectively utilised for the dissemination of tsunami warning messages	Partially	PNCC, the robust local government run telecom, supports the majority of the Palau voice, data and video traffic over Intelsat. A number of warning dissemination tools are available to disseminate warnings to the community. Further utilisation and coordination is required for the issue of tsunami warnings (refer above).
Issue of marine tsunami warnings and guidance for vessels, harbours and ports	Partially	Further consideration needs to be given to incorporating the Port Authority into tsunami warning plans to ensure effective and timely instructions are given to the ports and vessels. Port authority only monitors the VHF during working hours (8am-5pm daily). Currently there is a 24/7 hour watch at the patrol boat dock, but the watchstander has no access to VHF or HF radio at night. A marine warning hazard flag (different colours) can be flown at the port.
Emergency Response and Evacuation		
Disaster preparedness and emergency response system has been reviewed and opportunities for improvement and training identified	Partially	A National Disaster Plan (1998, D1) exists and is in the final stages of being reviewed (draft National Disaster Risk Management Framework (2009, D2)). The Disaster Risk Management National Action Planning is due to begin in 2010-12.
Tsunami emergency response, evacuation and recovery plan exists	No	A tsunami response, evacuation and recovery plan does not exist. When developed, this would most likely be a Sub-Plan to the reviewed NDRMF (D2).
The designated agency for evacuation is identified and have authority by law	Partially	The workshop stated that NEMO is the designated agency for issuing public evacuations. However, this is not clear in the National Disaster Plan (1998, D1). The workshop expressed that once the NEC is activated, authority can be given to the State Officers to complete public evacuations on behalf of NEMO.
Plans have been made for safe evacuation of population centres including aspects such as maps, routes and signage	No	No tsunami evacuation plans have been developed for Palau communities to date.
Procedures are tested and exercised to improve the response through better planning and preparedness	Partially	Exercise Pacific Wave 2006 was conducted down to the community level by Palau (including pre-exercise education and an evacuation drill). Palau participated in Exercise Pacific Wave 2008 but this stopped at NEMO. Aside from this, no national tsunami exercises have been conducted. Some other exercises (aviation, pandemic) are conducted and lessons learned completed but more on an agency basis.

Key Component	Rating	Comment
Emergency Response and Evacuation (<i>Continued...</i>)		
Land use policies and building codes are in place to mitigate against the tsunami hazard	Partially	While building permits are required, there are no formal building code requirements for Palau excepting for loans involving building insurance through the bank. Land management planning is largely centered on environmental and land right considerations. It would be beneficial if natural disaster hazard, risk and vulnerability was incorporated into this planning.
Tsunami hazard, vulnerability and risk		
Completion of studies to assess the tsunami hazard in the country or Region	Yes	Geoscience Australia has completed a Preliminary and Probabilistic Tsunami Hazard for the Southwest Pacific, including Palau (refer D27, D28).
Local risk assessments have been completed for at risk communities	No	No risk assessments have been completed at a community level for tsunami. This has been completed for climate change related sea-level rise in a few locations. Consideration of critical infrastructure has not been factored into disaster management planning.
Adequate data exists and local inundation modelling has been completed for population centres	Partially	There is a general lack of good quality topographic and bathymetric data to facilitate production of reliable inundation maps. The bathymetric data is based on 1930 Japanese surveys and has a high associated uncertainty greater than 10 metres. Some high resolution scans of the western channel to Koror have also been undertaken (USA Military 2007) but this data is not held in-country. The only land survey data has a resolution of 10 metres.
Public and Stakeholder Awareness, Education and Training		
Measures have been taken to ensure the public understand and take action in the event of a tsunami warning being issued	Partially	Some tsunami community awareness programs have been undertaken (see below) but these have generally included the science of tsunami and natural warning signs. Information regarding tsunami warnings and required response has been missing to date.
Community level education and preparedness programs exist for tsunami	Partially	NEMO have been coordinating and facilitating public town hall meetings in each State every two years on emergency preparedness. These meetings include education about moving to high ground if you feel an earthquake. Some tsunami community awareness on the Northern Atoll was completed before Pacific Wave 2006 in the form of town hall meetings. Draft natural hazard education materials (for example, typhoon, drought, earthquake, landslides and tsunami) have been developed for school grades Year 6 to 8. This material is currently under review with the Ministry of Education with the aim of this being incorporated into the science curriculum (some natural hazards curriculum exists but is not comprehensive).

Key Component	Rating	Comment
Public and Stakeholder Awareness, Education and Training (Continued...)		
Training programs for the National media exist for natural hazard and tsunami	No	Limited media training is undertaken on natural hazards. During an event, media is managed through the Palau Broadcasting Commission as well as a senior person speaking to the media based on prepared information. NWS has some media templates.
Public and Stakeholder Awareness, Education and Training		
Training programs exist for officials involved in tsunami warning and response	Partially	In general, agencies are responsible for identifying and meeting their own DRM training needs. NEMO has some disaster management training modules and has done an Introduction to Disaster Management workshops with some States. NWS staff are comprehensively trained through NOAA channels. No tsunami specific training was identified. Training needs analysis needs to be completed and a national training framework developed. A training database would also be beneficial. This is an identified need in-country. Current plans are to complete this as the second phase of the DRM National Action Plan process (due for completion 2010 - 2012).

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

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

Event Details: Solomon Islands – Magnitude 8.1, 45km south-southeast of Gizo (Solomon Islands), 20:39:56 Coordinated Universal Time (UTC), Sunday 1 April 2007 (2 April, 05:39am Koror local time).

All knowledge of the event was received through messages from PTWC and JMA. The PTWC message was received in a timely manner but was “Advisory Only” for Palau (no watch or warning was in place for Palau). Therefore, no national warning message was issued for Palau. The NEMO Coordinator was informed via a phone call to his home from the Japan Embassy after an employee of the Embassy saw the Japanese news on television. The NEMO Coordinator then called the NWS Director, who advised that there was no significant threat to Palau.

Palau had no knowledge of event detection (either seismic or sea-level) in real-time, other than what was included on international tsunami messages. The Malakal sea level gauge was in operation at the time but there was no access to this data by either NWS or the Ports.

Because no tsunami threat was expected for Palau and no national tsunami warnings were issued within the country, the community response was negligible. The public would call the NEMO phone line if they had any questions about the event. The paper would also be used to educate the public about the event.

Palau had a “Tsunami Response Plan” in place at the time but this was not activated because there was no threat to Palau from this event. This plan is procedures for receiving tsunami warnings from international watch providers, disseminating warnings nationally and activating the NEOC. The plan includes very little further detail on emergency response, evacuation and recovery. There is significant concern in Palau regarding “over warning” for tsunami events which may result in Palau's warning system becoming discredited.

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

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

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

5.3.1. Governance and Coordination	
Strengths:	Opportunities for Improvement:
- There is a national governance structure consisting of the CLT comprised of the President and Cabinet, NEC of 22 members including State Governors the Vice President as Chair and Chief of Staff as Vice Chair, the NEOC and ICP (a tactical location near the incident) to manage response during an event. - NEMO exists to coordinate disaster risk management planning in peace time and head up the NEOC during an event. - A National Disaster Plan (1998, D1) exists and is in the final stages of being reviewed (draft NDRMF (2009, D2)). - A State governance structure exists which has responsibility for village welfare and coordinates with traditional Palauan structures. Most States have DRM plans and a committee that is made up of the Governor and key elders. - Identified first response agencies exist including the Bureau of Public Safety who clearly takes direction from NEMO. - The NWS is a USA NOAA agency which operates under the Compact of Free Association with the USA. - Engagement of NGOs is primarily in emergency response and recovery and community awareness (For example CPR training). These include the Red Cross, traditional State level men, women and youth groups, religious groups, the Bealau Tourism Association and multicultural community clubs (such as the Filipino Community in Palau Group). The private sector is also engaged in DRM.	- The tsunami hazard is generally not addressed in disaster risk management planning. - The National Disaster Plan (1998, D1) review will be beneficial to enhance agency understanding of roles and responsibilities for DRM. - The NEC could benefit from meeting regularly outside of disaster events and incorporating mitigation and preparedness through the development of active Working Groups under this structure. - Coordination and cooperation across key stakeholders (PNCC, NEMO, Hospital, NWS, Lands and Survey etc.) requires improvement including sharing of plans (such as the National Disaster Plan and its revised version) and communication of capabilities, information and data to contribute towards DRM enhancement in Palau. - Coordination between the National and State governments could be enhanced through further enhancement of State DRM Plans in line with National plans as well as update of agency and organisation DRM plans. - NEMO is relatively under resourced to complete the tasks assigned to it under the National Disaster Plan (1998) and reviewed plans (four staff in total, anticipating two more in the next budget). - Roles and responsibilities for tsunami warnings are not clearly defined by legislation.

Governance and Coordination (Continued...)

Strengths (Continued...):	Opportunities for Improvement (Continued...):
- Article 8 Section 14 of the constitution provides Presidential authority for national disasters. Executive Order 166/99 provides NEC with authority and operationalises the constitution. - Recently \$100,000USD (United States Agency for International Development (USAID)) and \$600,000EU (World Bank) in grants have provided significant boost to build a new NEOC and NEMO office and improve communications infrastructure to outlying islands. - The Disaster Risk Management National Action Planning is due to begin in 2010-12.	- DRM arrangements and plans could be further linked to the village level. - Cooperation with NGOs could be further enhanced for emergency response and recovery.
Recommendations:	
1. Approve, adopt and implement the draft Palau NDRMF (D2) and progress towards incorporating this framework into legislation. 2. Each agency and organisation complete a multi-hazard DRM plan which considers tsunami (fast onset hazards) in line with their responsibilities outlined in the National Disaster Plan (1998, D1) and revised NDRMF when approved (D2). Complete in a standard format, in consultation with relevant stakeholders and share when completed. 3. On formal approval of the NDRMF develop a Palau National Tsunami Response Sub-Plan to clearly articulate PPRR for tsunami on a national level including mitigation, warning, response and regular testing of the system. 4. Incorporate tsunami warning and mitigation into State Disaster Risk Management Planning (either in existing plans or as a hazard specific Sub-Plan) and include planning for Village preparedness and response. 5. Enhance the NEC to ensure a multi-stakeholder forum exists to address DRM in a multi-hazard context. This should include all-hazard Working Groups for different aspects of DRM (for example, prevention, response). Ensure these Working Groups incorporate State and Village representatives, the private sector and other key stakeholders. 6. All agencies with key roles to play in the tsunami warning and mitigation systems are adequately resourced to carry out their nominated functions under the National Disaster Plan (1998, D1) (and revised framework when approved, D2). In particular, enhancement of NEMO human resources should be considered to allow them to meet their responsibilities.	

5.3.2. Regional and International Coordination

Strengths:	Opportunities for Improvement:
• Strong linkages with international agencies and donors to assist in DRM, including technical assistance and emergency response. These include SOPAC, SPREP, PIF, JMASEC, PTWC, CTBTO, IFRC, UNDP, International missions and aid agencies and various USA agencies. • Some cooperation with nearby nations in mutual support for relief efforts after major events such as Guam and FSM. • International assistance for emergency preparedness is received in the form of training, workshops and assistance with exercises (for example, The Asia Foundation (TAF) for the Office of U.S. Foreign Disaster Assistance (OFDA) 1999).	• There is limited communication between Palau and its near neighbours outside of recovery efforts after natural hazards. • Further use of education materials supplied to NEMO through international and regional interactions could enhance community awareness campaigns. • Could benefit from further involvement in international tsunami forums and the IOC.
Recommendations:	
7. Regular communication with near neighbours (for example, FSM, PNG) both at an operational and planning level will assist all involved to develop capacity to manage and respond to a range of natural hazards. This can be facilitated through involvement in forums such as the Pacific Platform for DRM. 8. Participate in the Southwest Pacific Tsunami Working Group of the ICG PTWS by nominating a representative of Palau to be on this working group. Use this group to learn about regional initiatives and initiatives of other PICs with regard to tsunami warning and mitigation systems in small island nations. 9. Become a member of the IOC to ensure Palau has a voice in determining IOC programmes and activities of benefit nationally as well as benefiting from IOC capacity building in marine science.	

5.3.3. Research Expertise

Strengths:	Opportunities for Improvement:
• There is a tertiary training facility in Koror, PCC which provides both core and tailored courses. • The population is well educated and supported by a high quality IT and communications infrastructure. • Palau has access to mapping and GIS information through PALARIS. This group appears to have good skill in IT, GIS and capacity to undertake modelling application work. • University of Guam assists Palau with Public Service communication systems such as Pan-Pacific Education And Communication Experiments by SATellite (PEACESAT), Radio and InterNET for the Communication of Hydro-Meteorological Information for Rural Development (RANET), State communications systems, VHF, HF and the Chatty Beetle as well as DRM workshops and training.	• There is no research into tsunami being undertaken in Palau • There is only a limited research skill base in Palau to support analysis and preparedness at a technical level in country.
Recommendations:	
10. NEMO, NWS, PCC and PALARIS work cooperatively with assistance from external technical agencies (such as SOPAC, PTWC, JMA, the Bureau, University of Hawaii and Guam etc.) to develop in-country scientific skills and knowledge of tsunami, other hazards and tools to improve in-country interpretation of international tsunami messages. 11. Investigate gaining access to a deep ocean tsunami model scenario database and the ComMIT community model for tsunami inundation (including appropriate training) to enable further determination of more specific threat information for Palau.	

5.3.4. Tsunami Monitoring Infrastructure

Strengths:	Opportunities for Improvement:
• There is one seismic station at PCC in Koror. The station is part of the JMASTEC network and the data is distributed internationally for inclusion in seismic evaluation. PCC has access to the seismic data collected on site and eight PCC employees have been trained to use the instrumentation. • There is one sea level gauge at Malakal, Koror Harbour. This is owned and maintained by the University of Hawaii and first in maintenance support is provided by the NWS. It transmits data via satellite to University of Hawaii and internationally on the Global Telecommunications System (GTS). • PALARIS has trained hydrographers who have access to the sea-level data from Malakal and other regional gauges. There is some interest in installing a network of tide gauges throughout Palau.	• Neither NEMO nor NWS have access to the seismic or sea-level data in real-time for operational use. This limits the capacity of Palau to use this data to make a country specific interpretation of international tsunami messages. • There is only one site in the country where sea-levels are monitored. Knowledge of the extent of the impact of tsunami and storm surge is therefore limited. • The extent to which seismic data from the one seismic station (located at PCC) is used for research is unclear. • The seismic station is seismically noisy. The workshop suggested they would like to relocate this elsewhere (the NWS was suggested). • There is only one surveyed and levelled sea-level gauge in Malakal harbour. This means that no other ports have any linkage to chart datum or to the Palau Height Datum for mapping. This limits the capacity to undertake inundation studies.
Recommendations:	
12. Nationalise international tsunami warnings through the NWS office obtaining access to the data from sea level gauges (coastal and deep ocean) in the region in real-time including training for staff on how to interpret this data and feed this data into operational tsunami SOPs. An immediate short term solution would be to access data via existing web links (The University of Hawaii http://uhscl.soest.hawaii.edu/ or IOC http://www.vliz.be/gauges/). Access to and training in the use of Tide Tool (PTWC developed) should be considered. 13. That Palau (NWS, NEMO with PALARIS and OERC) with external technical assistance, consider installing a sea level gauge network throughout Palau. This data would provide a better understanding of tsunami and improve reliability of inundation estimations. The data would also have multi-hazard and day to day uses.	

5.3.5. Tsunami Warnings

Strengths:	Opportunities for Improvement:
- NEMO and NWS have an established working relationship and have coordinated on a number of disaster events affecting Palau. - NWS operates 24/7 and has support from on-call staff. - NWS receives international tsunami messages primarily through PTWC by e-mail, fax, EMWIN and AISR with audio alert through internet via PNCC links. - NEMO (D18 are the current procedures and D3 are the reviewed procedures), NWS and PNCC have basic SOPs for actions taken when tsunami messages are received. When watches or warnings are received for Palau NWS contacts: - The Director of NEMO or Deputy (all NEMO staff called in); - The Palau NWS Office Manager; - PTWC to verify the tsunami threat; - If the tsunami threat is verified NEMO coordinates with the NEC and the President's office to approve Palau tsunami warning messages (including evacuation). The President activates the NEOC with NEMO assistance. - NWS selects relevant tsunami information for Palau from international bulletins and issues a Special Weather Statement containing the tsunami warning for Palau to the public via code-to-phone system, and via PNCC to TV and radio. - NEMO Palau Earthquake Response Procedures (D4) exist which include checking whether a tsunami has been generated. - A marine warning hazard flag (different colors) can be flown at the port. - Cancellations are issued based on PTWC Cancellation messages. - One helicopter that can be used when available for search and rescue and possibly to spread warning messages. Limited fuel range.	- Current tsunami warning processes are lengthy and complex, which could lead to a delay in issuing effective advice to the community - No secondary 24/7 agency receives tsunami messages. - There is little procedural guidance or skill base that enables NWS staff to assess the tsunami threat to Palau independently of international advisories. For example, specific consideration of areas at risk. - No interpretation can be made at this stage for differing levels of tsunami threat. For example, a tsunami that would pose a threat of strong marine currents rather than cause inundation. This could lead to a number of perceived "false alarms". - Palau does not issue "No Tsunami Threat" messages for tsunami that will not impact on the country, or earthquakes that do not have the potential to generate tsunami. Panic can be caused by media and public misinterpreting international tsunami messages. Issuing "No Tsunami Threat" messages for Palau will test the tsunami warning system more frequently, and enhance community awareness when there is a long time between events. - Palau could be better utilising the opportunities to integrate data and analysis tools into their tsunami risk assessment processes. For example, sea level data, travel time software.

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

14. That the full authority and responsibility for analysing and interpreting tsunami messages, tsunami data, and sending out tsunami warnings for Palau is formally delegated to the Palau NWS Office. Warning procedures must be pre-agreed and approved by key government stakeholders and include a tsunami warning decision making matrix that outlines what action will be taken for each international tsunami message received by Palau.
15. Develop, approve, share and maintain national tsunami warning and response SOPs for each agency involved in the tsunami warning and response process. In particular, for tsunami warnings, these procedures should include:
  - a. A comprehensive decision-making process (flow diagram) for the receipt and dissemination of tsunami warnings.
  - b. Procedures for what action will be taken in Palau for each type of international tsunami message received from PTWC and others;
  - c. Warning templates including “No Tsunami Threat” bulletins, Palau tsunami warnings and cancellations. Such templates must include pre-agreed and approved emergency response action statements to advise the public in affected areas on the action to be taken;
  - d. Agreed and regularly maintained distribution lists;
  - e. Use of available scientific information (deep ocean tsunami models, coastal and deep ocean sea level data, travel time software) to localise the tsunami threat to Palau. As the warning system matures, progressively move towards developing criteria for identify differing levels of tsunami threat (for example, marine currents only) as well as cancelling a Palau tsunami threat;
  - f. A process for issuing tsunami warnings to marine vessels and ports;
  - g. Procedures to carry out regular and ongoing system tests; and
  - h. Consideration of system redundancies, such as a second back-up agency in-country to receive the international tsunami messages.

5.3.6. Communications

Strengths:	Opportunities for Improvement:
• PNCC, the robust local government run telecom, supports the majority of the Palau voice, data and video traffic over Intelsat. • NWS has multiple paths for incoming PTWC alerts via the PNCC Intelsat supplied Internet or phone/fax lines with Iridium backup and EMWIN backup. • PNCC has EAS and Broadcast Short Message Service (SMS) capability. • There are Iridium backup (to the HF radios) phones on Tobi, Pula Ana and Sonsorol. There are many Iridium phones available around Koror. • Palau has two public FM broadcast and one AM Broadcast station with nation-wide coverage and are interested in improving emergency warning dissemination. This is particularly true of the AM station (Government owned and run). • Palau has local VHF (with some retransmitting repeaters) medical and marine two-way radio network around the central and northern areas of the Republic. • A number of warning dissemination tools are available to disseminate warnings to the community from NEOC including: ○ Activating the Koror emergency siren (slow wailing alert tone three to five minutes). ○ Contacting the following by phone: ○ The most vulnerable State first and other States. ○ Hotels on the coastline. ○ MoE (and schools if during the day). ○ Prepare official warning to radio stations. ○ Police. ○ Southwest island via their Koror liaison offices of Sonsorol and Tobi only (HF). ○ Remote northern areas via Police car top siren, bull horn or church bells through State Governors. ○ Resorts which have their own alarms, PA systems and procedures. • LRIT system exists, replacing old weather fax.	• EMWIN is re-transmitted on GOES 7 (USA NOAA's Geostationary Operational Environment Satellites). This satellite is running out of fuel with no replacement. • Palau is not currently using the EAS or SMS to disseminate warnings. EAS is in store at the Balau National Hospital. • The Iridium phones and HF radios in the southwest islands are turned off except when passing traffic. • None of the three broadcast stations dependably cover the southwest islands or all villages in the north. • RANET, HF and PEACESAT systems at NEMO NEOC are available but were not functioning at the time of the workshop. . • Island communication systems are not 24/7 to receive messages. • Radio stations are manned from 6am to 12 midnight, and are pre-recorded over night. The station manager is available emergency call-outs. • The government AM radio station is currently operating at less than 50% of their full coverage due to outdated and damaged technology. • The emergency siren is limited to Koror at present. • Bullhorns are limited (on 3 Police cars on the north island to cover 10 northern States). • Further consideration needs to be given to incorporating the Port Authority into tsunami warning plans to ensure effective and timely instructions are given to the ports and vessels. Port authority only monitors the VHF during working hours (8am to 5pm daily). Currently there is a 24/7 hour watch at the patrol boat dock. However, the watchstander has no access to VHF or HF radio at night. Police search and rescue boat radio requires improvement. • International tsunami SMS are not received in Palau at present. MOU between NWS and PNCC is required. • Update March 2010: Small Ku Band dishes have been installed in the Southwest. Training and configuration of systems required.

5.3.7. Communications (Continued...)**Recommendations:**

16. Investigate use of a 'Chatty Beetle' or RICS solution as a backup to EMWIN and the PNCC circuits to receive emergency warnings at the critical NWS Office portal in near future. Regular use of systems such as the 'Chatty Beetle' for weather observations ensures community skills are kept current.
17. NEMO, NWS Office, Koror Public safety 911 centre or the MoH emergency room should have interface hardware and software installed to send emergency cellular text and EAS TV text to disseminate warnings.
18. A 24/7 communication link to the remote Southwest Islands is established to disseminate emergency warnings. Recommend 'Chatty Beetle' or solar charged, permanently mounted Iridium handhelds in the MoH Emergency room and/or at the 911 call centre at the Koror Public Safety Office.
19. Palau should seek technical assistance to upgrade and maintain the AM broadcast station. AM radio signals can deliver disaster related warnings and updates to the Southwest Islands and the northern populations that are out of FM broadcast station range. Consideration should also be given to the remote trigger of a siren signal to the radio station.
20. Maintain and upgrade the central and north medical VHF two-way radio network as well as the VHF in the Rock Islands. Consider upgrading to a linked repeater system with full interagency interoperability.
21. Add RF or cellular triggered (with manual back up) sirens in all States.
22. Review and strengthen the requirements for marine users to have adequate radio communications on boats to ensure effective receipt of tsunami and other hazard warnings. Ensure the upgrade and maintenance of radio systems on Police search and rescue boats.

5.3.8. Tsunami Emergency Response (including evacuation)

Strengths:	Opportunities for Improvement:
• DRM Plans exist in Palau at a National (refer to 5.3.1) and State Government level. For example, Kayangel State Government, State Disaster Plan (D29), Sonsorol State Disaster Plan (D41), and Ngchesar State Disaster Plan (D47). • Some organisation emergency plans exist. For example, Palau Pacific Resort Tsunami SOPs (D5), PNCC Emergency Plan (D16, 1991), Belau Tourism Association, Recreational Tour Operators Committee – Emergency Action Plan (Water Related Emergencies) (D26, 2008). Most notably, the Belau National Hospital has an excellent suit of Emergency Operations Plans and Evacuation Plans (D8 to D15). The Palau Pacific Resort carries out fire drills annually. • The NEOC is activated, convening all important agencies and coordinating emergency response and messages to the public. • Emergency management organisations are involved in exercises on a regular basis (for example, pandemic exercise, mass casualty exercise at airport). • State Governors co-ordinate State-based emergency response. • Police has one to two operators to man 911 phones located at the Koror Police Station. • Typhoon shelters exist, primarily in schools. • Exercise Pacific Wave 2006 was conducted down to the community level by Palau (including pre-exercise education and an evacuation drill). Palau participated in Exercise Pacific Wave 2008 but this stopped at NEMO. • Good GIS information and skills exist in country (PALARIS and Lands and Survey). • NEMO has coordinated cross-agency drills for a range of hazards to Palau, with post-exercise reports written by agencies involved. • Inter-agency drills are carried out regularly, with agency process improvements implemented. • NEMO is the designated agency for issuing public evacuations. The workshop expressed that once the NEC is activated, authority can be given to the State Officers to complete public evacuations on behalf of NEMO.	• A tsunami response, evacuation and recovery plan does not exist. This would most likely for a Sub-Plan to the reviewed NDRMF (D2). NEMO and State Governments intend to develop this plan on formal approval of the draft NDRMF (D2). • There is a lack of SOPs for a tsunami event across all key emergency management agencies. • Lead time for safe community evacuation in the case of a tsunami has not been assessed and no evacuation plans, maps, routes and signage exist. • Whilst each State has agreed evacuation shelters (for typhoons), it was acknowledged that many of these are in low-lying coastal areas and may not be safe for tsunami. • Training of emergency management staff regarding short lead time events like tsunami is minimal. • While there are resources such as the Patrol Boat and the Bureau of Public Safety (Police) with potential to assist during an emergency, resource capability is minimal for emergency response to tsunami and other disasters. • While all critical infrastructure is mapped out, infrastructure has not been prioritised for emergency response to hazards. In general, GIS data and skills could better used for emergency planning and response. • State Disaster Plans exist. However, some plans are incomplete and do not include consideration of tsunami. Formalisation of EOC arrangements at the State level is required. • No comprehensive cross-agency lessons learned processes are completed for exercises. • Implementation of post-exercise recommendations has in some cases been hindered by a lack of funding.

*Tsunami Emergency Response (including evacuation) (Continued...)***Recommendations:**

23. Consideration should be given to development of emergency evacuation zones for tsunami and review of the placement of existing community emergency shelters for their community to ensure safety away from low-lying coastal areas (particularly for the low-lying southern States (for example, Tobi and Sonsorol). Evacuation authority should be incorporated into the revised NDRMF and associated legislation and tsunami evacuation plans incorporated into the Palau Tsunami Sub-Plan and State Plans.
24. Completion of outstanding State Disaster Plans and enhancement of existing plans to include consideration of tsunami, evacuation for tsunami, formalisation of State EOCs and traditional emergency response mechanisms (for example, the role of Chiefs).
25. Develop an information management system (database) to act as a central depository to ensure data available in-country, that may be useful for responding to a disaster, is available for real-time response. This data can also be used for preparedness planning (for example, mapping critical infrastructure).
26. Regularly test the tsunami warning system by conducting multi-agency exercises (including testing of emergency communication arrangements between key agencies). Complete post exercise lessons learned processes to guide SOP changes and staff training.
27. During a natural disaster emergency services may be isolated from parts of the Koror community due to loss of causeways or bridges. It is recommended Koror State Government continue to consider options for mitigating this risk, these may include back-up locations or multi-skilling of emergency services staff.
28. The hospital at Koror is currently vulnerable to a number of natural disaster threats, including tsunami, due to the proximity to the sea, the low-lying nature of the site and the potential for isolation from the rest of the Palau population (damage to causeways). Early stages of planning for a new hospital are progressing. Implementation of these plans is strongly encouraged from a multi-hazard perspective.

5.3.9. Tsunami Hazard, Vulnerability, Risk and Mitigation

Strengths:	Opportunities for Improvement:
• There is good quality geospatial information available in Palau for assessment of tsunami threats • NEMO has overarching responsibility for hazard and risk identification, with input from other agencies including NWS and PALARIS and State Governments. • GA has completed a Preliminary and Probabilistic Tsunami Hazard for the Southwest Pacific, including Palau (refer D27, D28). • The Coral Reef Research Foundation and Palau International Coral Reef Center have some bathymetry data and models, and resources for training. • PALARIS has the capability to assist in tsunami hazard and risk studies. They have carried out some preliminary evaluation of climate change using the existing topographical data which they consider inadequate for tsunami inundation purposes. • No tsunami records are kept in-country. There are ten reports of tsunami impact on Palau according to the National Geophysical Data Centre Tsunami Database. • The Coral Research Foundation also has current information which might be of value.	• While building permits are required, there are no formal building code requirements for Palau excepting for loans involving building insurance through the bank. • Land management planning is largely centred on environmental and land right considerations. It would be beneficial if natural disaster hazard, risk and vulnerability was incorporated into this planning. • There is a general lack of good quality topographic and bathymetric data to facilitate production of reliable inundation maps. The bathymetric data is based on 1930 Japanese surveys and has a high associated uncertainty greater than 10 metres. Some high resolution scans of the western channel to Koror have also been undertaken (USA Military 2007) but this data is not held in-country. The only land survey data has a resolution of 10 metres. • The community is not currently involved in the consultation process for developing and deciding risk avoidance and mitigation activities in regards to tsunami. • The lack of records regarding previous event and therefore lack of assessments make interpretation of model predictions of impacts on Palau difficult. • The only hospital in Palau is on low-lying land and isolated on the island of Arakabesan (Meyungs) from the island of Koror by a causeway. • Koror is made up of a number of islands joined by causeways and bridges. Damage to these during an event may result in isolation of communities, limiting the ability of emergency services to respond. Many essential utilities rely on the main bridge between Babeldaob Island and Koror.

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

29. Use existing tsunami hazard studies that have been completed for the Southwest Pacific Nations, historical records, GIS data and deep ocean models to identify low-lying communities which may be prone to tsunami impacts from all likely tsunami sources. Commence tsunami mitigation, response and evacuation planning using local knowledge.
30. Bureau of Land and Survey with PALARIS complete an inventory of the geospatial data available for tsunami and multi-hazard risk assessments and mapping of populated centres. In addition to low-lying residential and tourist areas this study needs to plot:
  - a. Vulnerable infrastructure including schools, hospital, dispensaries (considering the infirmed and elderly);
  - b. Critical services including power, water, sewerage and communications; and
  - c. Industrial infrastructure and services including oil storage and chemical manufacture and storage.
31. Acquire the necessary baseline data for populated areas to fill identified gaps as part of a multi-hazard (storm surge, tsunami, climate change) mapping activity using high resolution data collection methods such as Light Detection and Ranging (LiDAR).

5.3.10. Knowledge, Information, Public and Stakeholder Awareness and Education

Strengths:	Opportunities for Improvement:
Community Awareness - NEMO have been coordinating and facilitating public town hall meetings in each State every two years on emergency preparedness. These meetings include education about moving to high ground if you feel an earthquake. - Some tsunami community awareness on the Northern Atoll was completed before Pacific Wave 2006 in the form of town hall meetings. - Draft natural hazard education materials (for example, typhoon, drought, earthquake, landslides and tsunami) have been developed for school grades Year 6 to 8. This material is currently under review with the Ministry of Education with the aim of this being incorporated into the science curriculum. Some natural hazards curriculum exists but is not comprehensive. - The yearly national Science Education Week held at schools is a good platform for NEMO and other key emergency management agencies to incorporate awareness messages about tsunami. - NEMO has an existing working relationship with the PCC to develop better community awareness materials. - Palau has access to Pacific region community awareness materials about tsunami and natural hazards in general (for example, Survival Island). These relevant materials are a cost effective way of key emergency management agencies in Palau educating the community. - Palau has a strong literacy rate. - Education on typhoons and fire is conducted by NWS, NEMO and the Fire Department. This is mainly directed at schools and is primarily made up of presentations and brochures. Media - During an event, media is managed through the Palau Broadcasting Commission as well as a senior person speaking to the media based on prepared information. NWS has some media templates.	Community Awareness - Lack of awareness in the community due to lack of tsunami events. - The public could benefit from increased radio programs promoting hazard awareness, community education and training programs. - Staffing and financial resources are a barrier to ongoing community education programs. - Detailed tsunami education could be further incorporated into existing education programs including town hall meetings, the draft natural hazard education materials and national Science Education Week. - Further coordination of agency effort would enhance these programs. - No traditional knowledge of tsunami was identified through the Tsunami Capacity Assessment process. Media - Limited media training is undertaken on natural hazards. Specific training for all media on the nature of tsunami and how to inform the community when they receive a tsunami warning is needed. - Media can sometimes pick up messages from international media and misinterpret them. - Interaction between the NEOC and the media in real-time events could benefit from some further pre-planning with templates etc.

Knowledge, Information, Public and Stakeholder Awareness and Education (Cont...)

Strengths (Continued):	Opportunities for Improvement (Continued):
Training • There is some understanding in government and non-government agencies about tsunami facts. • NEMO has some disaster management training modules and has done an Introduction to Disaster Management workshops with some States. • Agencies are responsible for their own training needs. • NWS training is conducted every two years in NOAA NWS Pacific Regional Headquarters Hawaii. Some training is also completed by Guam Weather Forecast Office trainers in Palau.	Training • Funding is a barrier to a comprehensive training regime in-country. • Awareness in government and non-government agencies about tsunami facts could be further enhanced. • Further training is required in a number of areas. Training needs analysis should be completed and a national training framework developed. A training database would also be beneficial. This is an identified need in-country. Current plans are to complete this as the second phase of the DRM National action Plan process (due for completion 2010 – 2012).
Recommendations:	
32. Key Government agencies and NGOs work together to continue to build on the current DRM community awareness programs incorporating tsunami into the multi-hazard program that includes: a. A focus on communities at risk where possible; b. Agreement on key tsunami education messages for incorporation into all programs (for example, National Science Week); c. Continue with the integration of tsunami (and multi-hazard) information into the school curriculum; d. Look at opportunities to deliver educational messages about tsunami across a range of mediums (for example electronic media, brochures and face to face delivery); e. Further develop networks with international agencies such as the ITIC and SOPAC regarding using/adapting existing international materials about tsunami and other hazards; f. Review and evaluate awareness programs (through focus group testing, questionnaires etc) to ensure effectiveness of dissemination of information; g. Educate the community about how they will receive warning information and what to do; h. Ensure a process is designed and employed to educate the tourism industry about key tsunami messages and what to do in the event of a tsunami. The tourism industry can then employ an education process for divers and other visitors; i. Awareness about tsunami and other hazards be incorporated into certification and training of marine boat operators, including tour operators; and j. Identify and employ methodologies to cater for special needs and non-English speaking groups. 33. Key Government agencies work together on a media education and communication strategy that assists the media to understand hazards and warning procedures, forms agreement on approved media platforms for warning the community (for example, all radio stations) and develops templates for providing information to the media in a real event.	

Knowledge, Information, Public and Stakeholder Awareness and Education (Cont...)**Recommendations (Continued...):**

- 34.** NEMO progresses towards employing a national Public Information Officer to coordinate media liaison and monitoring before, during and after emergency events, lead community awareness programs and transfer information and skills from international and regional partners to benefit DRM in Palau.
- 35.** Completion of a training needs analysis and development of a national training framework for DRM in Palau (including a training database to track progress). Development of tsunami modelling capability at PALARIS could form part of the identified training needs.
- 36.** Development of a tsunami competency-based training program for the operational staff of key agencies (NEMO and NWS) to reflect tsunami operational practices as outlined in developed SOPs.
- 37.** Train remote island communities to be 'primary responders' (for example, island leaders) to disasters before help arrives. This should include maintenance and use of communications equipment.

5.4. Additional Workshop Benefits

In addition to this report, benefits of the tsunami capacity assessment workshop in Palau were:

- Improved understanding and documentation of capacity Palau's capacity to receive, communicate and effectively respond to tsunami warnings;
- Enhanced working relationships with counterparts and associated agencies and organisations;
- Exchanged information on respective activities and capabilities; and
- Enhanced working relationships between the Palau participants, the Bureau, AGD and the University of Guam.

5.5. Next Steps

Palau 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 in the hope of 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	Position	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
NEMO	Coordinator	Alonzo	Kyota	PO Box 100 Koror Palau 96940	488 2422	488 3312		nemo@palaunet.com
Palau Housing Authority	Gov.	Billy	Umang	PO Box 1092 Koror Palau 96940	488 6207	488 2442	775 0742	bumang@yahoo.com
EPFM/TBAA Radio Bureau of Domestic Affairs Ministry of State	Program Producer	Blas	Lawrence	PO Box 587 Koror Palau 96940	488 2417	488 1932	779 7609	blawrence@palaugov.net
Palau Horizon	Reporter	Cherrie	Villahermosa	PO Box 10207 Koror Palau 96940	488 4588	488 4565	779 3614	cherrie_pie2000@yahoo.com
BT & TCO	Chief Security	Columbus	Sakuma	PO Box 458 Koror Palau 96940	488 3032		779 5147	
Bureau of Land and Survey	Cartographic Tech II	Daniel	Ramariu	PO Box 100 Koror Palau 96940	488 2332			bls@pakumet.com
Bureau of Public Safety	Police Officer	Darwin	Siana	PO Box 2012 Koror Palau 96940	488 4742		779 0417	
NEMO	Admin Assistant	Dina	Sandei	PO Box 100 Koror Palau 96940	488 2249 488 2422	488 3312		nemo@palaunet.com
Sonsorol State	Governor	Domica	Albis	PO Box 1077 Koror Palau 96940	488 1237	488 5501	779 6537	sonsorol@palaunet.com
Hatohobei	It Governor	Dominic	Emilio	PO Box 1017 Koror Palau 96940	488 2218	488 5149		hsg@palaunet.com
PNCC	Operators ??? Manager	Edwina	Ngiraikelan	PO Box 99 Koror Palau 96940	587 9000	587 9015	775 2020	wina@palaunet.com
KS Government	Ranger	Elly	Esekiel		488 2150		775 1092	ellyezekiel@yahoo.com

Organisation	Position	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
Peleliu Ranger	Marine Officer	Elwais	Samil	Peleliu State ROP	345 1174			
Bureau of Domestic Affairs	Director	Eunice	Akiwo	PO Box 100 Koror Palau 96940	767 2343			eakiwo@palaugov.net
Palau Red Cross		Felix	Kyota	PO Box 907	587 5633			
Island Times	Editor	Fermin	Meriang		488 6168	488 6163	775 0076	tobe@rekki.com
PALARIS	Senior Hydrographer	Frank	Ohlingar	PO Box 1781 Koror Palau 96940	488 4334			ohlent@yahoo.com
Bureau of Public Safety	Fish and Wildlife officer	Friend	Taima	PO Box 1313 Koror Palau 96940	488 2487		779 9607	
Bureau of Public Safety/Min of Justice		Harvey Takesshi	Takaeshi		488 1422			
MPPIIC	Director, Bureau of Commercial Development	Hayes	Moses	PO Box 1471 Koror Palau 96940	767 4343	767 3207		dot@palaunet.com
Koror State Conservation and Law Enforcement	Director	Ilebrang	Ulkeriil	PO Box 116 Koror Palau 96940	488 4001	488 6683		coastalmgmt@kororstate.org
Melekeok State		Jason	Rebelkuul	PO Box 6042 Koror Palau 96940	488 2728		779 3428	Melekeok@govt
PALARIS	System Admin	Jeff	Tkel	PO Box 100 Koror Palau 96940	488 6654	488 6460		Palaris@palaunet.com
Bureau of Public Safety/Min of Justice	Police Sergeant	Jefferson	Epiich	PO Box 377 Koror Palau 96940	654 1422		779 9966	bpsfire@palaunet.com
NWS	SWSS	Joyleen	Tmatk	PO Box 520 Koror Palau 96940	488 1034	488 1436		joyleen.tmatk@noaa.gov
Bureau of Public Safety/Min of Justice	Police Officer III	Juan	Yagmai	PO Box 100 Koror Palau 96940	488 1422 488 5600		779 2452	Juanyaggy@yahoo.com
Ministry of E	Maintenance Supervisor	KaiLang	Asanuma	PO Box 189 Koror Palau 96940	488 2952	488 8465	799 7421	
PPUC	SCD	Ken	Sugiyama	PO Box 1372 Koror Palau 96940	488 3872			ken@ppuc.com

Organisation	Position	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
Koror State Conservation and Law Enforcement	Rock Islands Development Patrol Officer	King	Sam	PO Box 116 Koror Palau 96940	488 4001		778 9285	esuroi1@gmail.com
Japan Embassy	Consular Section	Kyoko	Emesiochel	PO Box 6050 Koror Palau 96940	488 6455	488 8065	775 6456	jpembassy.palau@gmail.com
Belau Tourism Association	Executive Director	Leah	Gillham	PO Box 9032 Koror Palau 96940	488 4377	488 3401	775 5371	bta@palaunet.com
Bureau of Public Safety/Min of Justice	Police Officer	Lee	Pedro	PO Box 10151 Koror Palau 96940	488 1045		779 6014	leepedro14@yahoo.com
Peleliu Ranger	Officer	Marc	Solang	PO Box 758 Koror Palau 96940	345 1004		779 2484	
NWS	MIC	Maria	Ngemaes	PO Box 520 Koror Palau 96940	488 1034	488 1436	775 0555	maria.ngemaes@noaa.gov
Palau Royal Resort	KR Assistant	Maria Gracie	Alernain	PO Box 10108 Koror Palau 96940	488 2000	488 6636		graciealenain@yahoo.com
NEMO	Admin Specialist	Maylene	Joshua	PO Box 100 Koror Palau 96940	488 2249	488 3312	779 2720	nemo@palaunet.com
Ministry of Justice	Police Officer III	Melvin	Ubedei	PO Box 1856 Koror Palau 96940	488 4657			m.ubedei@yahoo.com.au
Melekeok State		Mickey	Towai	PO Box 6042 Koror Palau 96940	488 2728		779 4609	Melekeok@govt
Sonsorol State	teacher	Nancy	Sabino	PO Box 10151 Koror Palau 96940			779 7767	
Angaur State Office	Add Clerk	Randy	Tomie	Medaiaii	488 3171	488 3858		
BT & TCO	Port Security	Reyhahti	Estahdiah	PO Box 318 Koror Palau 96940	488 3032 488 2402	488 2113	778 0144	btcc@palaunet.com
NWS	Weather Services Specialist	Rick	Dizon	PO Box 520 Koror Palau 96940	488 1034			rick.dizon@noaa.gov
Sonsorol State		Samuel	Beinar	PO Box 1312 Koror Palau 96940	488 1237	488 5501		
Ministry of Health	acting Clinical Director	Selarina	Lalabalava	PO Box 6027 Koror Palau 96940	488 2552	488 1211	775 1650	s_lalabalavu@palau-health.net

Organisation	Position	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
Ministry of Health Emergency Health	Adm Asst	Sharp	Sakuma	PO Box 435 Koror Palau 96940	488 6750	488 4800	775 0084	sharpsakuma@gmail.com
Palau Pacific Resort	Security Manager	Shirley	Odaol	PO Box 308 Koror Palau 96940	488 2600	488 1606	775 1294	sodaol@ppr-palau.com
MPPIIC	Chief Div Comm	Takkon	Chin	PO Box 1471 Koror Palau 96940	767 4343	767 3207		tchin@palaugov.net
Bureau of Public Safety/Marine Law Division	Police Sergeant	Ted	Ikeda	PO Box 42 Koror Palau 96940	488 5206		779 5986	bpspatrol@palaunet.com
PCOC	Executive Director	TMetuchl	Baules	PO Box 1742 Koror Palau 96940	488 3400	488 3401		pcoc@palaunet.com
Ngchesar State	Conservation Officer	Verano	Ngirkelau	PO Box 6025 Koror Palau 96940	488 2636			

6.2. Annexure 2: The Visiting Assessment Team

Team Position	Name	Position within Organisation	Organisation	Contact Details
Natural Hazard Warning Expert and Team Leader	Cherie Stitz (formally) O'Brien	Project Manager - PIC Tsunami Capacity Assessments	Australian Bureau of Meteorology	c.o'brien@bom.gov.au Ph. +61 3 9669 4065 Fax. +61 3 9669 4695
Data Communications Expert	Bruce Best	Telecommunications Expert	University of Guam	bbest.guam.net Ph. 1 671 735 2620
Emergency Management Expert	Terri Reid	Project Manager National Security Capability Development Division	Attorney-General's Department	terri.reid@ag.gov.au Ph: +61 2 6141 4563 Fax: +61 2 6141 3998
Trip Logistics Coordinator & Training Expert	Ross Bunn	Australian Tsunami Warning System - Competency Based Training	Australian Bureau of Meteorology	r.bunn@bom.gov.au Ph. +61 3 9669 4298 Fax. +61 3 9669 4366
Advisor, Hazard Assessment	Jane Warne	ATWS Project Manager Network Design	Bureau of Meteorology	j.warne@bom.gov.au Ph. +61 3 9669 4721 Fax. +61 3 9669 4803

6.3. Annexure 3: Agenda, Palau Tsunami Capacity Assessment Workshop

National Capacity Assessment of Palau's Tsunami Warning and Mitigation System

WORKSHOP AGENDA 11 to 14 August 2009

DAY 1: 11 August 2009

SESSION 1: OPENING CEREMONY AND INTRODUCTORY PRESENTATIONS

LOCATION: Koror State Assembly Hall

Time	Item	Questionnaire Reference	Duration	Participation
9.00 – 9.30am	Welcome Address • Issac Soaladaob, Chief of Staff of the Presidents Office • Cherie O'Brien, Team Leader, Visiting Assessment Team	NA	0.5hrs	Open
10.00 – 10.30am	Workshop Group Photo and Opening Morning Tea	NA	0.5hrs	Open
10.35 – 11.00am	CHAIR: Cherie O'Brien Housekeeping Presentation – Introduction to the tsunami capacity assessment project and, tsunami science Presenter: Cherie O'Brien, Team Leader, Visiting Assessment Team	NA	0.5hrs	Open
11.00 – 11.30am	Presentation – The tsunami hazard in relation to Palau Presenter: Jane Warne – Risk Assessment Expert (Bureau of Meteorology)	NA	0.5hrs	Open

Time	Item	Questionnaire Reference	Duration	Participation
11.30 – 12.00pm	Presentations – <i>Tsunami warning and mitigation systems in Palau</i> (including questions from participants) Presenters: Maylene Joshua (Administration Specialist, NEMO)	NA	0.5hrs	Open
12.00 – 1.30pm	Lunch	NA	1.5hrs	Open
SESSION 2: ORGANISATIONS, COMMITTEES, LEGISLATION, STRATEGY AND COOPERATION				
LOCATION: Koror State Assembly Hall		CHAIR: Cherie O'Brien, Team Leader, Visiting Assessment Team		
1.30 – 2.30pm	Focus Groups • <i>Palau's priorities for implementing an effective tsunami warning and mitigation system</i>	Section 4	1.0hrs	Open
2.30 – 3.00pm	Capacity Assessment – Organisations, Committees and Legislation			
	• <i>Organisations involved in tsunami warning and mitigation in Palau</i>	Section 2, Part A	0.5hrs	Open
	• <i>Tsunami warning and mitigation coordination committees at Village and National levels in Palau</i>	Section 2, Part B		
	• <i>Legislation relevant to tsunami warnings and emergency response</i>	Section 2, Part C		
3.00 – 3.30pm	Afternoon tea	NA	0.5hrs	Open
3.30 – 4.30pm	Capacity Assessment – Strategy, International and Regional Cooperation, All Hazards Approach			
	• <i>Disaster risk reduction strategy in Palau</i>	Section 2, Part D	1.0hrs	Open
	• <i>International and Regional cooperation for tsunami warning and mitigation in Palau</i>	Sec 2, Part E & F		
	• <i>All-hazards approach</i>	Section 3		
4.30pm	CLOSE	Section 3		

DAY 2: 12 August 2009**SESSION 3: RESEARCH, MONITORING AND WARNING****LOCATION: Koror State Assembly Hall****CHAIR: Cherie O'Brien, Team Leader, Visiting Assessment Team**

Time	Item	Quest. Reference	Duration	Participation
8.30 – 9.00am	Opening Presentation: • NWS – Presenter: Ms Dilwei Maria Ngemaes (Palau NWS) • End-to-end Tsunami Warning System Requirements • Data Communications for Tsunami Warnings (including questions from the participants) Presenter: Ross Bunn (Bureau of Meteorology) & Bruce Best (University of Guam)	NA	0.5hrs	Open
09:00 – 09:30am	Capacity Assessment – Research, Monitoring, Warning and Emergency Response			
09:30 – 10:00am	Research and development expertise	Section 5	0.5hrs	Open
10.00 - 10.30am	Morning Tea	NA	0.5hrs	Open
10:30 – 11.00am	Tsunami monitoring including: • Tsunami monitoring infrastructure (seismic network, sea-level network and utilisation of satellites for data communication) • Case Study – April 2007 Solomon Islands Event	Section 6, Part A, B, C & Case Study – Monitoring Systems	0.5hrs	Open
11.00 – 12:00pm	Tsunami warning system in Palau including: • International communication cooperation • National tsunami warning centre • Receipt of advisories from PTWC • Procedures for dissemination of tsunami warnings Nationally	Section 7, Part A, B, C, D, E, F, G, Case Study – Tsunami Advisory Messages and Warnings & Part H	1.0hrs	Open

Time	Item	Questionnaire Reference	Duration	Participation
	Tsunami warning system in Palau <u>continued</u> including: • Issuing warnings for marine vessels, harbours and ports • Case Study – April 2007 Solomon Islands Event • Conclusion – Strengths and weaknesses of tsunami warnings	As above	As above	As above
12.00 – 1.00pm	Lunch	NA	1.0hr	Open
SESSION 4: SITE TOURS				
LOCATION: TBC				
1:30 – 4.00pm	• PNCC • Palau Patrol Boat • Belau National Hospital.	NA	2.5hrs	Relevant Agencies & Assessment Team

DAY 3: 13 August 2009**SESSION 5: TSUNAMI EMERGENCY RESPONSE, MITIGATION AND PREPAREDNESS****LOCATION:** Koror State Assembly Hall**CHAIR:** Cherie O'Brien, Team Leader, Visiting Assessment Team

Time	Item	Questionnaire Reference	Duration	Participation
8.30 – 9.00am	Opening Presentation: Emergency Coordination, Planning, Community Awareness (including questions from participants) Presenter: Terri Reid (Attorney-General's Department)	NA	0.5hrs	Open
9.00 – 10.00am	Emergency response to tsunami in Palau - Assessing the capacity of the disaster management system in Palau and identifying training needs - Emergency response and recovery plans - Evacuation (including evacuation legislation)	Section 8, Part A, B & C	1hr	Open
10.00 – 10:30am	Morning Tea	NA	0.5hrs	Open
10:30 – 12.00pm	Emergency response to tsunami in Palau <u>continued</u> including: - GIS use for emergency response - Testing and exercising - Consideration of critical infrastructure - Tsunami mitigation efforts - The role of NGOs in tsunami warning and mitigation - Case Study – April 2007 Solomon Islands Event	Section 8, Part D, E, F, G, H & Case Study – Preparedness and Response	1.5hrs	Open
12.00 – 1.00pm	Lunch	NA	1hr	Open

Time	Item	Questionnaire Reference	Duration	Participation
SESSION 6: TSUNAMI HAZARD, VULNERABILITY, RISK AND COMMUNITY AWARENESS				
1.00 – 4:30pm	Capacity Assessment – Hazard, Vulnerability, Risk and Community Awareness			
1.00 – 2.00pm	Tsunami hazard, vulnerability and risk studies in Palau: • <i>Post tsunami surveys</i> • <i>Tsunami hazard, vulnerability and numerical modelling studies</i> • <i>Community participation in assessing the tsunami risk</i>	<i>Section 9, Part A, B, C, D, E, F</i>	1hr	Open
2.00 – 3.00pm	Public and stakeholder awareness and education regarding tsunami in Palau including: • <i>Assessment of public awareness</i> • <i>The role of public awareness in understanding warnings and taking action</i> • <i>Public awareness and education programs</i> • <i>Media education programs</i> • <i>Tsunami memorials and museums</i>	<i>Section 10, Part A, B, C, D</i>	1hrs	Open
2.30 – 3.00pm	Afternoon Tea	NA	0.5hrs	Open
3:30 – 4.00pm	Public and stakeholder awareness and education regarding tsunami in Palau including: • <i>Assessment of public awareness</i> • <i>The role of public awareness in understanding warnings and taking action</i> • <i>Public awareness and education programs</i> • <i>Media education programs</i> • <i>Tsunami memorials and museums</i>	<i>Section 10, Part A, B, C, D</i>	1hrs	Open
4.00pm	CLOSE			

DAY 4: 14 August 2009**SESSION 6: PRESENTATION OF PRELIMINARY ASSESSMENT FINDINGS****LOCATION:** Koror State Assembly Hall**CHAIR:** Cherie O'Brien, Team Leader, Visiting Assessment Team

Time	Item	Questionnaire Reference	Duration	Participation
10:30 – 11:00	MORNING TEA		0.5hrs	
11.00 – 12.00pm	Preliminary summary presentation Palau's strengths, opportunities for improvement, preliminary recommendations, priority review and next steps Presenter: Cherie O'Brien, Team Leader, Visiting Assessment Team Questions and Feedback <i>From Palau participants on preliminary summary presentation and the assessment process in general</i>	NA	1hrs	Open
12.00 - 12.15pm	ACKNOWLEDGEMENTS AND CLOSE - Palau Representative TBC - Cherie O'Brien, Team Leader, Visiting Assessment Team	NA	0.25hrs	Open
12:15/12:30pm	CLOSING LUNCH	NA	1hr	Open

6.4. Annexure 4: Supporting Documents Log

Ref.	Document Name	Copy Obtained (Y/N)	Format (H = Hard Copy) (E = Electronic)
D1	National Disaster Plan (1998)	Y	E
D2	Draft National Disaster Risk Management Framework (2009) – Working Draft 2	Y	E
D3	Palau Tsunami Threat Response Procedures – NEMO (NEW)	Y	E
D4	Palau Earthquake Response Procedures - NEMO	Y	E
D5	Palau Pacific Resort Standard Operating Procedures - Tsunami	Y	E
D6	Palau Horizon Tuesday August 11 -13 2009 (Tsunami Workshop Article p. 3)	Y	E
D7	“Palau National Disaster Plan Reviewed” – Media article, Saipan News	Y	E
D8	Belau National Hospital Emergency Operations Plan	Y	E
D9	Republic of Palau, Public Health Emergency Operations Plan	Y	E
D10a	Evacuation Plan for Belau National Hospital (Updated by Dr Erik Koda as of January 29, 2009)	Y	E
D10b	Evacuation Plan for Belau National Hospital - PowerPoint	Y	E
D11	Hospital Disaster Drill Evaluation Sheet (Blank)	Y	E
D12	Hospital Incident Command Post Tree	Y	E
D13	STRAT Triage PowerPoint	Y	E
D14	STRAT Decision Tree	Y	E
D15	MOR: Emergency Notification/Telephone Tree (Revised: 2/10/03)	Y	E
D16	PNCC Emergency Plan 1990 (requires updating when Draft National Disaster Risk Management Framework 2009 is updated)	Y	E
D17	PTWC Information Bulletin 2301Z on 12 August 2009	Y	E

Ref.	Document Name	Copy Obtained (Y/N)	Format (H = Hard Copy) (E = Electronic)
D18	Palau Tsunami Response Procedure – NEMO (CURRENT)	Y	E
D19	Environmental Vulnerability Index Country Profile Review Palau	Y	E
D20	Information on Palau Red Cross Society	Y	E
D21	Review of the 1999 National Disaster Plan Koror, Palau, 6th – 10th April 2009 (SOPAC Trip Report 470)	Y	E
D22	EU-funded Disaster Risk Reduction Project (BEnvelope) in Palau – Consultation with the Government of Palau to finalise the Country Implementation Plan (SOPAC Trip Report 450)	Y	E
D24	State names and land area (public and private) from Lands and Survey	Y	E
D25	United State Department of Interior Sept 1971 – Land Areas by State and Island	Y	E
D26	Belau Tourism Association, Recreational Tour Operators, Committee – Emergency Action Plan (Water Related Emergencies) August 2008	Y	E
D27	A Preliminary study into the Tsunami Hazard faced by Southwest Pacific Nations (Thomas, C., Burbidge, D., Cummings, P., 2007)	Y	E
D28	A Probabilistic Tsunami Hazard Assessment of the Southwest Pacific Nations (Thomas, C. and Burbidge, D. 2009)	Y	E
D29	Kayangel State Government, State Disaster Plan, Draft 1	Y	E
D30	GIS Project Area: Ngerchemai Hamlet (NEMO Presentation) Identifying low-lying areas for tsunami (and other costal hazards) using contour mapping	Y	E
D31	Earthquake Response Activities	Y	E
D32	School Presentation on Typhoons and Tropical Storms	Y	E
D33	Marine Advisory System Brochure-English	Y	E
D34	Melekeok Elm. School Emergency Procedures / Guidelines Presentation (NEMO)	Y	E
D35	Search and Rescue Response Operations – Marine Operations	Y	E

Ref.	Document Name	Copy Obtained (Y/N)	Format (H = Hard Copy) (E = Electronic)
D36	Tsunami Brochure-English2	Y	E
D37	Typhoon Safety Tips and Response Actions	Y	E
D38	List of Typhoon Shelters-Koror	Y	E
D39	Typhoon and Tropical Storm Safety Tips – English (NEMO)	Y	E
D40	State Disaster Plan Progress List (NEMO)	Y	E
D41	Sonsorol State Disaster Plan	Y	E
D42	Red Cross Iridium Phone Registry	Y	E
D43	PNCC Emergency Plan 1990	Y	E
D44	Tsunami Workshop Coverage - Palau Horizon (Fri 14 Aug 09, p8)	Y	E
D45	Tsunami Workshop Coverage – Island Times (Fri 14 Aug 09, p1)	Y	E
D46	PALARIS Sustainable Land Management Project Brochure	Y	E
D47	Ngchesar State Disaster Plan	Y	E
D48	Act to provide authority for Disaster Plan for Ngchesar State	Y	E
D49	PALARIS GIS Brochure	Y	E
D50	Brochure – El Nino, Preparing for Drought (NEMO)	Y	E
D51	Brochure- Earthquake Tips (NEMO)	Y	E
D52	Boating Safety Card	Y	E
D53	Workshop Participant Responses PPRR Worksheets	Y	E
D54	Workshop Opening Speech – Isaac Soaladaob	Y	E

6.5. Annexure 5: Definitions

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

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

Capacity

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

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

Capacity building

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

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

Disaster

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

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

Disaster risk management

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

Disaster risk reduction (disaster reduction)

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

Early warning

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

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

Emergency management

The organisation 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 utilised, with the corresponding effects on different segments of the population or interests of a community taken into account in resulting decisions.

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

Land-use planning can help to mitigate disasters and reduce risks by discouraging high-density settlements and construction of key installations in hazard-prone areas, control of

population density and expansion, and in the siting of service routes for transport, power, water, sewage and other critical facilities.

Mitigation

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

Natural hazards

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

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

Preparedness

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

Prevention

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

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

Public awareness

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

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

Recovery

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

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

Relief / response

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

Resilience / resilient

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

Risk

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

Conventionally risk is expressed by the notation

Risk = Hazards x Vulnerability

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

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

Risk assessment/analysis

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

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

Structural / non-structural measures

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

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

Vulnerability

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

6.6. Annexure 6: References

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Section

7

7. CD Attachment

7. CD Attachment - Supporting Documents

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

