



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

Papua New Guinea



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SOPAC



Section

1

1. Results Outline

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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 Papua New Guinea (hereafter referred to as “PNG”) to receive, communicate and effectively respond to tsunami warnings took place in a workshop held from 21 – 24 October 2008 in Port Moresby, PNG. A return visit in November 2009 further reviewed and cemented the results of the assessment. Since the workshop, some recommendations have progressed. These include review of disaster management legislation and work on tsunami Standard Operating Procedures (SOPs).

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

As well as outlining PNG’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 PNG’s tsunami warning and mitigation system.

The vulnerability of PNG’s population to tsunami is compounded by the traditional coastal way of life which revolves around living and working by the sea. The size and topography of the country, the limitations of the transport and communications systems and the remoteness of communities makes preparing for, warning for and responding to disasters a challenging task.

In the late 1970s, the late Ian Everingham developed a catalogue of tsunami that had occurred in the then New Guinea and Solomon’s region. There have been approximately 50 tsunami in PNG waters in the last hundred years, including moderate events that preceded the eruptions of Rabaul volcano 1937 and 1994 (D1, p. 2). Notable PNG tsunami throughout history include 1855 or 1856 Rai coast tsunami southeast of Madang, 1888 tsunami generated by the collapse of the Ritter Island volcano, 1930 tsunami along the Bogia coast (Madang Province) and in the Ninigo Islands and the devastating Aitape tsunami in 1998 in which more than 2200 people lost their lives (D8). Various studies highlight the main tsunami threat source for PNG as the Solomon’s, New Guinea and Mariana trenches. Whilst the majority of tsunami are caused by fault displacements in the sea floor, Papua New Guinea’s northern coast is also subject to tsunami which may be caused by submarine volcanic activity, or by the mass wasting of volcanoes.

PNG has also experienced tsunami from distant sources. The 8.4 magnitude 1960 Chile earthquake caused a tsunami arrived in PNG 22 hours later, causing waves of one to two metres in height and some flooding in the New Guinea Islands and at Wewak (Everingham, 1977). The Anchorage, Alaska, earthquake of 1964 generated a tsunami that reached PNG waters 11.5 hours later (D8).

Locally generated events on the northern coast could have very short travel times, such as the 1998 Aitape tsunami which was reported to have arrived 15-20 minutes after the seismic event. Due to the short travel time (10 to 30 minutes) from local sources it is impossible to provide timely warnings. This must be considered in any education planning. Communities must be made aware of the natural warning signs of tsunami (shake, drop, roar, run – Refer to Figure 4).

Disaster Risk Management (DRM) in PNG exists under the framework of the PNG Disaster Management Act (D12). This Act then relies upon the country's National Disaster Management Plan to further establish the framework of responsibility and action for the management of disaster events. The National Disaster Committee exists, as do Provincial Disaster Committees. The National Disaster Centre (NDC - PNG's equivalent of what is referred to as the National Disaster Management Office in Pacific Island Countries (PICs)) and Provincial Disaster Centres exist with varying levels of effectiveness depending on the Province in question.

NDC has ultimate responsibility for issuing warnings for tsunami. Port Moresby Geophysical Observatory (PMGO) receives messages from Pacific Tsunami Warning Center (PTWC) and Japan Meteorological Agency (JMA) via fax and e-mail. PMGO then coordinates with NDC (who receives the same) to issue tsunami warnings (per. comm Lawrence Anton, PMGO, 26 February 2010). Neither the PMGO nor NDC can currently provide the critical 24/7 coverage that is required for a fully effective tsunami warning service. Although plans to rectify this situation are in place, this is currently a significant gap in the country's tsunami warning system. Tsunami warnings are also received by PNG's National Weather Service (NWS), who is 24/7, via Emergency Managers Weather Information Network (EMWIN), Aeronautical Fixed Telecommunications Network (AFTN), Fax and e-mail. The Rabaul Volcano Observatory (RVO) also receives these messages.

Enhancement of the use of current communication systems, as well as implementation of new technologies, could assist to solve the current ineffectiveness of disseminating tsunami and other warnings out of hours. Due to PNG's local tsunami risk, enhanced community awareness and preparedness is vital to ensure communities are prepared for tsunami and act based on warnings received or on natural tsunami warning signs.

Participants in the Tsunami Capacity Assessment workshop stated a number of priority areas for improvement that need to be addressed. Recurring themes included improved coordination, user friendly availability of information and databases, best use of resources, effective protocols for warning dissemination to all stakeholders and more proactive community awareness. The workshop's resulting recommendations reflected these priorities. Very high priority recommendations made include:

- Development of a Tsunami Response Plan that clearly defines the roles, functions, authorities and responsibilities of all organisations and agencies (public and private sector) at the National and Provincial levels.
- Development and documenting of SOPs for all agencies.
- The review of the National Disaster Management Plan to further enhance legislated responsibilities, strengthen the role of the National Disaster Committee and develop strategies to integrate the private sector into the plan.
- Formally review the resource requirements of the NDC and PMGO that would enable them to maintain a 24/7 all-hazard watch and warning service including tsunami (including redundant communications systems).
- Develop a communications plan that includes first alert capability (wake-up call) at remote communities and a strengthened primary tsunami warning communication network.
- Task Provincial Disaster Coordinators to identify and advertise tsunami evacuation routes for the communities in their areas of responsibility.
- Further develop and enhance the current community awareness media campaigns and integrate the disaster awareness initiative, including tsunami, throughout all levels of the education curriculum.

PNG 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 PNG's tsunami warning and mitigation system. In turn, this will assist in improving systems for other high priority natural hazards.

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



Figure 1: The Wave. Painting by Lucas Rawah of Aitape (source D10).

1.2. Recommendations (including priority and resource intensity)

Table 2 outlines the priority and resource intensity for recommendations made to improve PNG'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 and with in-country experts during visits to key agencies (including in November 2009). 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 PNG's tsunami warning and mitigation system.

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

Table 1: Priority ranking and resource intensity scale

PRIORITY	RESOURCE INTENSITY
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 PNG’s tsunami warning and mitigation system.

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific benefits	Recommendation Number In Table 4
Very High	Ensure existing communications mechanisms are well used to ensure reliability and save lives by running an education and training program. To be of value in a disaster, all office radios must have the volume up with an operator nearby monitoring. Budget for routine battery replacement and maintenance funds for remote emergency radio stations.	Low	Communications	Multi-hazard	19
Very High	Further develop and enhance the current awareness media campaigns.	Low	Knowledge, Information, Public & Stakeholder Awareness & Education	Multi-hazard	31
Very High	The highest priority is given to the development of a Tsunami Response Plan that clearly defines the roles, functions, authorities and responsibilities of all organisations and agencies (public and private sector) at the National and Provincial levels.	Medium	Governance & Coordination	Tsunami Specific	1
Very High	Development and documenting of SOPs for all agencies, these documents need to be coordinated between agencies.	Medium	Governance & Coordination	Tsunami Specific	2
Very High	Formally review the resource requirements of the NDC and PMGO that would enable them to maintain a 24/7 all-hazard watch and warning service, including tsunami. This must include formal review of communications system requirements, training and maintenance.	Medium	Tsunami Warnings	Multi-hazard	12

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific benefits	Recommendation Number In Table 4
Very High	<p>Develop a consolidated communications plan: The plan could include:</p> <ul style="list-style-type: none"> a. More VSAT (Very Small Aperture Terminal) stations with connections to HF and cellular networks; b. The purchase and installation of secure ground station equipment; c. Develop a funding plan to cover reoccurring satellite costs, maintenance and training for sustainability; d. Install a VHF (Very High Frequency) base at the NWS, since it is the only 24/7 office that is equipped with HF (High Frequency), fax and data links; e. Data exchange traffic handled by the Port Moresby NWS staff from remote VSATs; f. Educate all health, religious and government HF/VHF capable networks to the fact that the NWS is monitoring a HF/VHF channel; and, g. Strengthening of communication systems at PMGO and NDC. 	Medium	Communications	Multi-hazard	20
Very High	Strengthen the primary tsunami warning communication network to ensure that tsunami information is received and actioned in a timely manner regardless of the hour. Design and develop a back-up network.	Medium to High (depending on action taken)	Communications	Multi-hazard	18

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific benefits	Recommendation Number In Table 4
Very High	<p>Review the National Disaster Management Plan, including:</p> <ul style="list-style-type: none"> a. Ensure sound legislation exists for DRM responsibilities and warnings at a national and Provincial level; b. Further strengthen the role and authority of the National Disaster Committee and associated subcommittees, integrating tsunami consideration into these committees in an all hazard approach; and c. The development of strategies to integrate the private sector into the plan. 	High	Governance & Coordination	Multi-hazard	4
Very High	Investigate a communication system that provides a first alert capability (wake-up call) at remote communities (such as the RANET (Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information) Chatty Beetle that can be triggered by the responsible warning agency to wake up village leaders).	High	Communications	Multi-hazard	17
Very High	Task Provincial Disaster Coordinators to identify and advertise tsunami evacuation routes for the communities in their areas of responsibility.	High	Tsunami Emergency Response (including evacuation)	Tsunami Specific	22
Very High	Integrate the disaster awareness initiative, including tsunami, throughout all levels of the education curriculum. Ensure this includes natural warning signs for tsunami and action that should be taken by communities in response to these signs or receiving a warning from authorities.	Low	Knowledge, Information, Public & Stakeholder Awareness & Education	Multi-hazard	33

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific benefits	Recommendation Number In Table 4
High	Ensure that project agreements with international donors for upgrade of equipment includes sharing of data internationally in real time and suitable data formats to facilitate improvements of accuracy of messages from international tsunami warning providers.	Low	Tsunami Monitoring Infrastructure	Tsunami Specific	11
High	Re-establish the National Disaster Committee Communications Working Group to coordinate multi-agency communication systems.	Low	Communications	Multi-hazard	16
High	Test, evaluate and validate the viability of existing and newly developed SOPs via a practical exercise prior to their operational adoption and then on a regular basis.	Low	Tsunami Emergency Response (including evacuation)	Tsunami Specific	21
High	Appoint a “public information officer” with responsibility to develop and enhance a multi-hazard awareness campaign at the community level.	Low	Knowledge, Information, Public & Stakeholder Awareness & Education	Multi-hazard	32
High	Review the current process for the receipt of tsunami warnings to improve the timeliness of dissemination and redundancy in the receipt and dissemination system.	Medium	Tsunami Warnings	Tsunami Specific	13
High	A position of Emergency Co-ordinator for recovery be established at NDC.	Medium	Tsunami Emergency Response (including evacuation)	Multi-hazard	23

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific benefits	Recommendation Number In Table 4
High	Complete comprehensive tsunami hazard analysis and mapping to enhance the warning system and identify vulnerable areas based on the tsunami catalogue, past areas of inundation, Geographic Information Systems (GIS) data and deep ocean models to identify low-lying communities which may be prone to tsunami impacts from all likely sources. Make the information readily accessible in a user-friendly format.	Medium	Tsunami Hazard, Vulnerability, Risk & Mitigation	Tsunami Specific	24
High	Identify training needs by completion of a training needs analysis and development of a national training strategy for DRM in PNG (including a database to track progress).	Medium	Knowledge, Information, Public & Stakeholder Awareness & Education	Multi-hazard	34
High	Continue work towards completion of a PNG DRM National Action Plan (NAP) to allow for a nationally coordinated and strategic approach to DRM in PNG.	High	Governance & Coordination	Multi-hazard	5
High	Strengthen the capacity of PMGO to fully utilise, maintain and sustain the new seismic network, including developing a maintenance program funded by the PNG Government.	High	Tsunami Monitoring Infrastructure	Multi-hazard	9
High	On completion of natural hazards (including tsunami inundation) modelling, revise the building code, at least for critical infrastructure.	High	Tsunami Hazard, Vulnerability, Risk & Mitigation	Multi-hazard	30
High	Introduce a competency-based training approach to the development of skills and knowledge in the field of DRM across key government agencies. This should include development of a tsunami competency-based training program for the operational staff of key agencies to reflect tsunami operational practices as outlined in developed SOPs.	High	Knowledge, Information, Public & Stakeholder Awareness & Education	Multi-hazard	35

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific benefits	Recommendation Number In Table 4
Medium	The contact list recorded from this workshop is expanded to provide an all-hazards contact list as a reference group for liaison and further development to effectively meet the tsunami threat.	Low	Governance & Coordination	Multi-hazard	3
Medium	Consideration is given to a “twinning” arrangement with an international agency that has operational tsunami warning responsibility	Low	Governance & Coordination	Multi-hazard	6
Medium	Develop the protocols for the reception of international technical experts for impact assessments post tsunami and other disasters.	Low	Research Expertise	Multi-hazard	7
Medium	Log all warning messages received and transmitted by the responsible warning agency and key recipients.	Low	Tsunami Warnings	Multi-hazard	14
Medium	Establish a national scientific body/committee to co-ordinate, prioritise and facilitate the exchange of existing tsunami research.	Medium	Research Expertise	Tsunami-specific	8
Medium	Develop a media program to raise awareness of the importance and need for the respect of early warning equipment and prevent vandalism.	Medium	Tsunami Monitoring Infrastructure	Multi-hazard	10
Medium	Continue integrated all-hazard Community-Based DRM programs for at risk communities.	Medium	Tsunami Hazard, Vulnerability, Risk & Mitigation	Multi-hazard	25
Medium	Establish a database of traditional knowledge on early warning signs and coping mechanisms, including recovery. The study should include capturing disaster stories.	Medium	Tsunami Hazard, Vulnerability, Risk & Mitigation	Multi-hazard	26
Medium	Identify potential losses due to tsunami impacts as an advocacy and planning tool to encourage investment in tsunami risk reduction.	Medium	Tsunami Hazard, Vulnerability, Risk & Mitigation	Tsunami Specific	27

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific benefits	Recommendation Number In Table 4
Medium	Investigate how the use of available scientific information (deep ocean tsunami models, coastal and deep ocean sea level data, travel time software, and eventually seismic data) can be used by the scientific and warning agencies to localise the tsunami threat to PNG.	High	Tsunami Warnings	Tsunami Specific	15
Medium	Acquire high resolution near-shore bathymetry and topography data to enable tsunami inundation modelling of major urban centres at risk as part of a multi-hazard mapping activity.	Very High	Tsunami Hazard, Vulnerability, Risk & Mitigation	Multi-hazard	28
Medium	Investigate options for completing tsunami inundation modelling, particularly for population and infrastructure centres that are identified as being vulnerable to tsunami.	Very High	Tsunami Hazard, Vulnerability, Risk & Mitigation	Tsunami Specific	29