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U.S. Contribution to the Indian Ocean Tsunami Warning System

U.S. INDIAN OCEAN TSUNAMI WARNING SYSTEM (IOTWS) PROGRAM

REVIEW OF POLICIES AND INSTITUTIONAL CAPACITY FOR EARLY WARNING AND DISASTER MANAGEMENT IN THAILAND

JANUARY 2007

January 2007

This publication was produced for review by the United States Agency for International Development. It was prepared by the IRG-Tetra Tech Joint Venture.

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Prepared for U.S. Agency for International Development
by IRG & Tetra Tech Joint Venture under Contract No. EPP-I-02-04-00024-00

U.S. IOTWS Program Document No.17-IOTWS-06

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CONTENTS

ACRONYMS

ADPC	Asian Disaster Preparedness Center
BMA	Bangkok Metropolitan Administration
CERD	Civil Emergency Relief Division
CRED	Center for Research in the Epidemiology of Disasters
DAD	Development Assistance Database
DAO	District Administrative Organization
DDPM	Department of Disaster Prevention and Mitigation
DMCR	Department of Marine and Coastal Resources
DMR	Department of Mineral Resources
DOLA	Department of Local Administration
DOPA	Department of Provincial Administration
DPT	Department of Public Works and Town Planning
EWS	Early Warning Systems
GTS	Global Telecommunication Systems
EOC	Emergency Operation Center
ICRC	International Committee of the Red Cross
IFRC	International Federation of Red Cross and Red Crescent Societies
IOTWS	Indian Ocean Tsunami Warning System
IRG	International Resources Group
NCDC	National Civil Defense Committee
NDMO	National Disaster Management Organization
NDWC	National Disaster Warning Center
NGO	non-governmental organizations
NSCT	National Safety Council of Thailand
PAO	Provincial Administrative Organization
PMO	Prime Minister's Office
RID	Royal Irrigation Department
RTN	Royal Thai Navy
SIDA	Swedish International Development Cooperation Agency
SMS	Short Message Service

SNAP	Strategic National Action Plan
SOP	Standard Operating Procedure
TAO	Tambon Administrative Organization
TMD	Thai Meteorological Department
TRCS	Thai Red Cross Society
UNDP	United Nations Development Program
UNESCO-IOC	United Nations Educational, Scientific, and Cultural Organization Intergovernmental Oceanographic Commission
USAID	U.S. Agency for International Development
WMO	World Meteorological Organization

PREFACE

This activity is under the US IOTWS program area 3: "National Dissemination and Communication of Warnings" and sub-component 3a: "National Disaster Management Capacity Building". The study focuses on the capacities of the National Disaster Management Organizations (NDMOs) and the various factors such as policies, legislation, and institutional systems that govern disaster risk management in the study areas. Nan Borton, a consultant of the International Resources Group (IRG), and Ramraj Narasimhan and S.H.M. Fakhruddin of the Asian Disaster Preparedness Center (ADPC) carried out this study over a period of two weeks on behalf of the US IOTWS Program.

This study undertook an analysis of data to inform policy to support NDMO operations, building on the IOC assessment report completed in December 2005 and including a further gap analysis. The study builds upon the premise that early warnings will only be as effective as the collective strengths of policies, laws, institutional frameworks, and capacities of national and local officials responsible for disaster management systems; hence this activity will clarify and advance the political mandate for disaster management responsibilities in Thailand. It also assesses policy and regulatory frameworks that define Thailand's approach to disaster management. As indicated in the program document, it also supports targeted national policy and regulatory interventions that strengthen overall national emergency management organizations and systems.

The methodology for the study involved the development of a comprehensive instrument using an indicator-based approach for each element that makes up Thailand's disaster management system. All available secondary information in the form of reports, prior assessments, and others were thoroughly read and assimilated before undertaking the interviews in Thailand, which focused on meeting with the key stakeholders with a role in disaster management and seeking additional information or filling in gaps.

The study was greatly facilitated by the excellent guidance and advice provided by the US IOTWS teams in Bangkok, Colombo, and Jakarta, and from ADPC. Finally, the excellent cooperation received in the form of frank and constructive discussions with all of the stakeholders interviewed made this review possible.

INTRODUCTION

This report is intended to supplement and update the many excellent assessments that have been undertaken on disaster management and early warning systems in the five tsunami-affected nations. Consequently, it does not repeat the data already available to the reader from other comprehensive reports, such as the one prepared by the United Nations Educational, Scientific, and Cultural Organization Intergovernmental Oceanographic Commission (UNESCO-IOC). Neither does this report cover geographic, demographic, or country statistics, all of which are readily available from other sources.

We do include a disaster history for Thailand (see Annex B), taken from the hazards history data base assembled at the Center for Research in the Epidemiology of Disasters (CRED) in Belgium. In general, the 2004 tsunami greatly increased awareness of disasters within Thailand, with floods, typhoons, drought, and landslides being the major hazards in this country.

No nation has in place a system that could have escaped the devastation of the tsunami of December 2004. It was simply too huge, too unexpected (in countries like Thailand and Sri Lanka, which have no tsunami history), and too unpredicted to be manageable by any system in the world. This elementary and obvious fact needs to be remembered by all who are working on improving existing systems. These improvements are necessary and extremely useful, and will extend the lead time people have when a disaster is predicted. However, no technology and no system can fully forestall the destruction and death of a magnitude 9 earthquake close to heavily populated shores, as happened that Sunday morning.

It is an assumption of this study that an early warning system is only as good as the nation's capacity to respond promptly to its messages. Therefore, this study looks at the disaster management systems as a whole: preparedness, mitigation and prevention, response, and recovery. These elements inevitably cross into areas covered by ministries without disaster portfolios: land use, agriculture policy, public works, and the like. It is through the awareness of these mainline ministries that actions can be taken that directly link disaster preparedness and mitigation with social and economic development. Without being embraced by the system as a whole, with all elements functioning together, early warnings are unlikely to result in significant improvements in disaster preparedness, prevention, and mitigation.

METHODOLOGY

A three-person team, all with training and experience in end-to-end disaster management, undertook to develop a comprehensive instrument to measure the status of the design and development of policies, institutions, resources, and players that must come together to ensure effective and timely utilization of improved early warning. This institutional diagnostic matrix includes four levels of sophistication for each element being assessed; concrete indicators are given for each of these four levels. The matrix can be read alone as a summary of team findings. The report explains why the team made the judgments it did, and it is laid out in the same outline as the matrix, for easy cross-referencing.

The team conducted interviews with institutions relating to disaster management: the government, the police and the military, and civil and NGO structures. Notes from all three interviewers were then used as inputs to the matrix.

This report was then prepared from the notes of all team members in the matrix and follows its outline. The matrix itself, with the scores the team agreed upon for each element, is attached (Annex A). Annex C contains a list of persons interviewed.

1. POLICY AND LEGISLATIVE ENVIRONMENT FOR DISASTER MANAGEMENT

1.1 LEGISLATIVE ENVIRONMENT

Thailand has largely been free from disasters—periodic flooding and an occasional typhoon have been its concerns. The disaster management system in existence prior to the 2004 tsunami has evolved from the Civil Defense Act 1979 and the Bureaucratic Reform Act 2002.

The Civil Defense Act 1979 defines what constitutes a disaster, identifies agencies responsible for disaster management and their responsibilities, and systematically addresses disaster management for both natural and man-made hazards. The Bureaucratic Reform Act 2002 resulted in consolidation of various programs with different government agencies under the umbrella of the Department of Disaster Prevention and Mitigation (DDPM) of the Ministry of Interior. This Act also reassigned lead roles to specific departments for different phases of a disaster coordinated by the DDPM. The main responsibility of DDPM is to formulate policies and guidelines and to identify tools for disaster reduction, including research and development on disaster prevention and early warning systems.

The 2004 tsunami, which would have been beyond the capacities of most advanced nations, severely tested the capacity of the DDPM, an institution of only two years. The tsunami event exposed the institutional gaps in relation to what would have been required to respond sufficiently. Thus, Thailand created a new institution, the National Disaster Warning Center (NDWC), with somewhat overlapping responsibilities with other national agencies to ensure coverage in all similar national disasters. This institution still has a tenuous legal base under the authority of the Office of the Prime Minister, with an Act or a Royal Decree pending to be finalized. This results in a wait-and-see mode for other institutions that feel challenged by its creation. The draft authority for NDWC has been finalized but not yet approved by the cabinet due to a recent (September 2006) government change.

1.2 INSTITUTIONAL ENVIRONMENT

The framework for disaster management in Thailand adopts a multi-stakeholder approach with the involvement of many institutions at the national, provincial and local levels. However, this mosaic is not altogether complete, with some gaps and some overlaps. At the risk of oversimplifying, we can say that there are two types of institutions for disaster management in Thailand. First, the relatively new institutions such as DDPM and NDWC, which have disaster management as their sole responsibilities, and secondly, the various long-standing departments and technical agencies that have some role in different phases of the disaster management cycle. These two sets of institutions come under the overall purview of the National Civil Defense Committee (NCDC).

The National Civil Defense Committee (NCDC), formed under the Civil Defense Act of 1979 as a strategic policy-making body chaired by the Minister of Interior to formulate civil defense measures and policies, is composed of 17 representatives from various ministries with DDPM as its secretariat. It has provincial, district, and sub-district civil defense committees under the command of the Provincial Governor, District Deputy and the Tambon Head, respectively. However, the NCDC meets irregularly and the strategic direction it should provide is not apparent on the ground.

The National Safety Council of Thailand (NSCT) is another disaster management-related mechanism dealing with man-made and technological hazards, such as chemical hazards, occupational hazards, accidents in the home and public venues, fires in high-rise buildings, and others. NSCT is tasked with

the development of policies, national safety plans, guidelines for coordinating the activities of all relevant agencies as per the plan, and public education on safety-related issues.

The DDPM as an institution is also relatively new having been established in 2002, and it is developing its own capacities. It has a presence at the national level and in all of the provinces (with the exception of Bangkok Metropolitan Area), and it is responsible for early warning dissemination, preparedness, mitigation, and response aspects of disaster management. With the creation of the NDWC, some of its responsibilities appear to be duplicative. DDPM has a very collaborative approach and works with all the relevant technical institutions, such as the Department of Mineral Resources (DMR), the Thai Meteorological Department (TMD), the Royal Irrigation Department (RID), and others in activities such as landslide risk mitigation and flood preparedness. The DDPM has a national academy, which is currently conducting trainings for its own staff and some government stakeholders. It has 12 regional centers that act as its outreach centers across the country. The DDPM has both operational responsibilities due to its local level presence and policy making/guideline preparation responsibilities.

The NDWC was established under the Office of the Prime Minister regulation B.E. 2548, as a focal point for end-to-end and multi-hazard early warning systems (EWS) for Thailand. The NDWC is a very young institution, operational since mid-2005, and is composed of technical and managerial staff seconded from various government entities. This has resulted in the depletion of capabilities of the contributing agencies, for example, through the transfer of scientists and technicians from the Thai Meteorological Department, Royal Thai Navy, Department of Mineral Resources, etc. At a workshop supported by the US IOTWS Program, representatives of NDWC clearly outlined the agency's institutional framework and a concept of operation for information flow and decision making. However, they were not well circulated or well known to other stakeholders. Initially, its mandate extended to early warning particularly for tsunami, but the Center appears to have been directed by the past Prime Minister to adopt a multi-hazard approach and address the entire disaster management system. This overlaps with some functions of the DDPM and is discussed at length in Section 2.

Technical departments such as the DMR and TMD are strong and collaborate with both the DDPM and the NDWC. The lack of a comprehensive policy setup and legislative framework however limits this collaboration to a basic level. Collaboration with institutions such as the Department of Public Works & Town Planning (DPT) too is more on reconstruction efforts. Here, already available landslide risk maps are not fully integrated into their development planning while some initiatives on disaster-cognizant building codes are under development. The lack of an overall policy framework that binds all of these capable institutions clearly hinders progress in the disaster response and management field in general for Thailand.

1.3 POLITICAL ENVIRONMENT

In the aftermath of the tsunami, there was great political commitment to disaster management, which manifested in increased budget allocations for disaster-related activities and in the creation of the NDWC directly under the PM's office. It also provided support for strengthening early warning capacities of the region. With the new government in place after the coup in September 2006, the whole political administration was revamped and all ministerial portfolios reallocated. The Committee for Development of an Early Warning System and the NDWC still remain under the chairmanship of the personnel hand-picked by the previous administration. Thus progress of the last year has not been disrupted. However, the pace of activities in NDWC has visibly slowed down, with the exit of the government that created and propelled NDWC to the center of action.

With the bureaucratic reforms effected in 2002, the Provincial Governors are also vested with a lot of power in overseeing activities in the province, which should, at least in theory, help implement local level risk reduction activities. The many committees that are mandated at the local levels however were not always formed, indicating that disaster management was not a priority—probably because major disasters have not been a common occurrence in Thailand's history. The 2004

tsunami has changed that perception and the government appears to be taking the disruptions caused by the routine floods more seriously.

1.4 POLICY FORMULATION

As highlighted above, the absence of a comprehensive policy framework means that various policies operate in isolation, resulting in lack of integration among these different stakeholders. There are more than 10 different laws and institutions responsible for the management of coastal resources. Similarly absence of a policy to coordinate agencies and departments such as the RID, DDPM, and Public Works, so that each takes into account the plans and projects of other agencies and the impacts of their activities, remains a concern in the case of flood mitigation. Development activities such as housing and related infrastructure such as roads and highways also do not fully consider disaster risk reduction, resulting in increased risks.

Activities of the Department of Town Planning remain largely response-oriented. Proactive use of currently available risk maps and other similar information is not apparent, even when there are policies and/or legislation guiding land use and other resources management. Enforcement of these laws is notoriously lax. For example, even though policies were prepared for setbacks during the reconstruction after the tsunami, they were not generally implemented. Many people opted to remain close to or within vulnerable areas. In some cases people moved into the national park areas after the tsunami, and later on they received ownership from the Government for permanent housing. Despite tourism being one of the main sources of foreign exchange, a concerted attempt has not been made to promote a concept of tsunami-prepared hotels and tourist infrastructure in the coastal areas. During the tsunami response, the absence of clearly defined regulations and procedures resulted in INGOs and foreign agencies facing various difficulties in registering themselves and in implementing their activities.

Even in the absence of clear guidelines and policies, some agencies such as the DMR believe in the importance of public awareness at local levels and send its staff to the villages to impart knowledge about hazards that they are vulnerable to, such as landslides, and how to prepare and live with them. In spite of the above mentioned weaknesses in policy and enforcement, it should be noted that the concerned agencies have sincerely been looking for solutions. However, because of the speed of events post-tsunami, they were often overwhelmed with the demands for answers to thorny questions regarding coastal setbacks, reconstruction planning, and implementation. As in other countries, the pressure to rebuild in the coastal strip is extremely high, given private ownership of land and the value people place on being close to the sea.

1.5 POLICY SUPPORTS DISASTER MANAGEMENT AT ALL LEVELS

To an extent, existing policies support disaster management at the local level as well as at the national level. The provincial governors are empowered to exercise their coordination powers through the Provincial Civil Defense Committee, comprised of government agencies involved in disasters and, to an extent, technical and human resources from DDPM provincial units. Relevant bodies such as Flood Mitigation and Preparedness Committees are established in disaster-prone areas to prepare and plan for the periodic flooding events. Provincial governors and other local agencies prepare their own damage assessments and requests for relief, repairs, and rehabilitation. In addition, governors can also use a reserved fund of 50 million baht, which is available for major disasters.

Similarly at the district level, the District Chief Officer heads the District Civil Defense Committee, while the Municipal Civil Defense Committee is headed by the Mayor. The Tambon Administrative Organization is also involved in preparing annual budgets for disaster/emergency relief and collaborates with the District Committees. However, many of these arrangements, at least at the local levels, are aimed at disaster response and not as much for preparedness or mitigation. Policies,

as discussed, do not really push for substantive collaboration for disaster reduction in on-going development at these levels.

1.6 INVOLVEMENT OF OTHER GOVERNMENT STAKEHOLDERS

Since no policies for disaster management have been formulated yet, it is premature to discuss the involvement of other stakeholders. But, judging by the current situation, the process is likely to be consultative involving the other stakeholders. Right after the tsunami and several flash floods in the north, DDPM developed an operational guideline/policy for disaster management. This has been the approach adopted for the Strategic National Action Plan (SNAP) exercise initiated by the Government of Thailand in collaboration with the United Nations International Strategy for Disaster Reduction (UN/ISDR) under the Hyogo Framework for Action 2007-2016, which consolidates action plans for over 40 stakeholders. While this does not make up for the absence of an overall DM policy or a disaster management plan, it is a step in the right direction.

1.7 LINKAGES WITH OTHER GOVERNMENT POLICIES

As illustrated earlier, sectoral policies act independently without the benefit of an over-arching policy framework to integrate them. Limited collaboration is taking place in the absence of such a framework. There are visible gaps in linkages with other government agencies. As an example, coastal management authorities are slowly becoming more integrated. The Departments of Fisheries, Land Development, and Forestry are separate and all have distinct jurisdictions in coastal areas. Mangroves, for example, come under the purview of National Parks, Forestry, and the Department of Marine and Coastal Resources, and there is a tremendous need for coordination. In response, there are now efforts underway to prepare a comprehensive policy to address coastal zone management.

2. NATIONAL DISASTER MANAGEMENT OFFICE OR EQUIVALENT

2.1 MANDATE

2.1.1 GOALS AND OBJECTIVES OF NDMOS

There are two national disaster management entities in Thailand. In addition, there are many other government entities that are involved in various phases of disaster management. A set of goals and objectives exist for each of the two agencies directly responsible for disaster management, which overlap and duplicate each other. At the outset it appears that the NDWC is mandated only for warning generation and dissemination, with all other aspects being handled by DDPM. NDWC is responsible for planning, coordinating, controlling, implementing, and preparing the national warning systems and equipment. This includes studying the technical expertise to disseminate knowledge to the public and related agencies for reducing disaster impacts and mitigating disasters effectively. Some NDWC plans infringe on and duplicate activities already being carried out by the DDPM, e.g. awareness raising, search and rescue, etc. Similarly, DDPM is also involved in disaster warning communication, awareness programs on warning, and developing Standard Operating Procedures (SOPs) through its own infrastructure. The technical agencies appear to have adjusted to this situation and collaborate with both.

The DMCR is still Thailand's focal point for the UNESCO-IOC early warning systems, since the NDWC was established only in mid-2005.

2.1.2 MANDATE IS RECOGNIZED AND ACCEPTED BY OTHERS

All agencies recognize the mandates of NDWC and DDPM, but based on the interview results, it is not clear whether the agencies accept and collaborate fully with them. The role of NDWC is not understood by many stakeholders. NDWC has taken steps to rectify this through a participatory program called "Adaptive Learning in Disaster Management for Community Awareness and Resilience" initiated in the provincial, district, sub-district, and village levels to understand community needs and create awareness of their roles and responsibilities. NDWC has also organized several meetings with all relevant departments to develop the concept of operation and other tools; as a result, some agencies recognize its role and responsibilities, but the situation is still gloomy at the local level. In the case of DDPM, its mandate is recognized and to an extent accepted, but its coordinating role is not. It also appears that different agencies carry out their activities in isolation. Disaster risk reduction is not a major concern and is not mainstreamed, which is probably an indication of DDPM and NDWC not being able to collaborate fully with these agencies.

DDPM's local units are already accepted at the provincial and local levels. NDWC is also gaining ground and has held meetings with the governors to impress upon them the involvement of the Center in generating the warnings. The elements of a functional warning system are in place already, but this can be further improved.

2.1.3 INSTITUTIONAL STRUCTURES

The NDWC was established in May 2005 as the agency responsible for aspects relating to the generation of early warning for multiple hazards and its dissemination to various stakeholders at the national and provincial levels. Initially the Center was under the Prime Minister's Office (PMO), but with the recent change of government it remains without any link to the PMO.

DDPM is the other center for disaster management of longer duration under the Ministry of Interior. This was created in 2002 as a result of the bureaucratic reforms and is closely linked to other institutions of the Ministry of Interior, such as the Department of Provincial Administration (DOPA).

The Department of Mineral Resources (DMR) was established over a century ago mainly for mining concessions and related activities. However, after Typhoon Gay hit the country in 1989, disasters (especially landslides and floods) became more frequent and have caught national attention. After a series of landslides and sinkholes in the 1990s, DMR took up the additional responsibility for geohazards. DMR produced studies on factors related to these occurrences and criteria for identifying landslide-prone areas. The studies found that many other sites in Thailand could be vulnerable to landslides, resulting in the preparation of landslide risk maps. Subsequently, the Cabinet assigned responsibility for landslides studies to DMR. The reforms of 2002 resulted in the re-organization of DMR into four separate departments. Furthermore, DMR formerly reported to one minister, but it now reports to three ministers who each have responsibility for various technical areas. This has reduced its clout and the financial and technical resources available to it.

The Thai Meteorological Department (TMD) covers both meteorological and seismological disasters. For the latter, TMD has earthquake monitoring systems in Thailand, with 14 analog stations and 11 digital stations linked to the headquarters in Bangkok. After the tsunami, this system has been expanded to 15 digital and 20 analog stations. A further upgrade is planned in 2007, which will increase the number of systems linked to Bangkok in real time. Traditionally, TMD analyzed the data and issued warnings, but with the establishment of NDWC, it now informs the NDWC when warnings need to be issued. With all the technical personnel at hand, it also manages the equipment budget, contracting, and maintenance for NDWC.

The Royal Thai Navy's Hydrographic Department conducts hydrographic and oceanographic surveys to aid navigation and install buoys for navigation purpose. It also supports TMD with data on water level changes and tsunami detection. Prior to 2004, its equipment was all analog, and consequently they did not capture the tsunami information in time. After the tsunami, its budget was increased and they now have 28 stations, of which 14 are digital with real time readouts and the rest are analog, which send information every month. By next year, the system will be upgraded to send information to TMD in real time. The Hydrographic Department is responsible only for the data and not for warnings, which is an NDWC responsibility. They continue to play their supporting role to TMD effectively. Other than these, the Royal Irrigation Department (RID) distribute water level information in the rainy seasons.

As discussed, at the provincial and district levels the Provincial Governor and the District Chief Officer lead the civil defense committees, which coordinate the local-level preparedness and response activities with the support of the provincial DDPM units. These institutional structures percolate to the local level on paper. But it appears that unless a disaster has manifested itself in the area before, some of these committees do not really exist and function at the local levels.

2.1.4 ADMINISTRATIVE STRUCTURES

For coordination, administrative structures exist at all levels from the national Civil Defense Committee headed by the Minister of Interior to the local tambon-level committees. It is quite clear found that the Provincial Governor is fully empowered to take decisions; the dissemination of warnings, response, and relief are timely and not dependent on any clearance from the central authorities.

In Bangkok, the DDPM, DOPA, and the NDWC report to the Civil Defense Committee; their local counterparts and the DOPA in the provinces are under the command of the Provincial Governors.

The response can commence at the local (e.g. provincial) level under the leadership of the Governors whose office will be supported by the local DDPM units. The provincial administration also collaborates with the local civil society and the Red Cross, and can also seek assistance from the

Center. According to a simulation drill exercise of NDWC these administrative structures are vibrant and ensure that the warnings are transmitted in less than 40 minutes from the Center to the communities.

2.1.5 POLITICAL ENVIRONMENT

Political support for disaster management is unclear, especially with a new administration at the helm. NDWC, as an institution created by the previous administration to showcase the significance given to disaster management and to make visible changes happen immediately, appears especially vulnerable. Staff morale is not very high and their parent organizations do not appear that supportive. There is also no law to formalize the creation of the NDWC.

DDPM, as an institution of longer standing, appears to be more accepted and part of the system, compared to the NDWC. The political environment, while very supportive in the aftermath of the tsunami, does not appear to be so anymore for DDPM. This is probably one of the reasons why, despite being a Vice Minister and the Executive Director of NDWC under the previous administration, the incumbent continues in his position and established the Center in a very short time.

2.2 DISASTER MANAGEMENT CAPACITIES

2.2.1 TECHNICAL AND HUMAN RESOURCES

DDPM appears to have its full complement of staff at the national level, except in the recently created academies. Even the regional centers are quite well-resourced. There are plans for recruitment at the local level for DDPM units, which support the provincial and district administration. DDPM staff comprises a mix of administrative and technical personnel; some feel that its local units need more trained personnel. There are over 100 staff at national level, and DDPM plans to recruit more staff in each of the 75 provinces to assist the provincial governments. The new staff will be provided training in different areas as required at the local levels.

NDWC being a newly established organization is managing with personnel seconded from various ministries and departments such as TMD, the Royal Thai Navy, DMR, and even DDPM. The NDWC is under-staffed and most of its staff is not permanent. This Center needs to build their in-house capacity for analyzing and assessing warning information. Currently there are 85 personnel in NDWC, with proposals to increase to its full complement of 272 staff members, many of whom will be on shifts to keep it operational 24/7. NDWC plans to utilize various maps identifying the risk-prone areas for different hazards to be able to provide warning information with a greater level of details. Recently, NDWC developed their strategic plan for an early warning system and proposed a four-year research program with a vision to provide an effective, accurate, and complete EWS. The plan will also ensure people's confidence on EWS and develop international collaborations (e.g. with India, Pacific Tsunami Warning Center (PTWC), Japan Meteorological Agency (JMA), etc.)

DMR has only 100 geologists in the Geological Survey Bureau to cover risk-prone areas across the entire country, so it collaborates with other agencies to multiply its reach. Since DDPM has many staff members in the local areas, DMR works closely with DDPM to educate people. In addition, the DMR trains DDPM staff to understand the nature of geology and its risks so in the future they can identify possible geohazard risks.

The Flood Crisis Management Center in the Bangkok Metropolitan Administration (BMA) is very well-resourced and equipped. Structural mitigation especially for flood prevention is carried out with the local government budgets.

2.2.2 RESOURCES AND PLAN FOR COMMUNICATION OF EARLY WARNING

Traditionally there have been very strong multiple channel communication links and procedures from the central to the provincial and district levels through the Ministry of Interior communication systems. After the tsunami, this has been further strengthened.

NDWC has leased line connectivity with TMD to obtain seismic, weather, and Global Telecommunications System (GTS) and World Meteorological Organization (WMO) data. It is also linked with the Hydrographic Department of Royal Thai Navy to obtain tide gauge data. In addition there is bilateral cooperation with Australia, India, Malaysia, Singapore, Indonesia, Maldives, and Myanmar to exchange and share information. TMD carries out the data analysis and, prior to the establishment of NDWC, issued warnings as needed within 15 minutes of data reception. Now, if the analysis indicates an earthquake above a certain magnitude, TMD informs NDWC, which issues the warning. NDWC receives warning information from TMD and the Hydrographic Department using a dedicated line.

The NDWC sends warning information through various channels, including TV, radio, fax, SMS, telephone, and warning towers. NDWC has also installed 99 towers along the coastline of southern Thailand, which are activated remotely through satellite to broadcast warnings or messages in five languages: Thai, English, German, Mandarin Chinese, and Japanese, taking into account the tourists who flock to the coastal areas. In the second phase, 48 additional towers will be installed in southern Thailand along the eastern coast, and another 144 towers in central, northern, and northeastern Thailand will be installed in the next phase. Operation of these towers will be integrated with TMD, RID, and the Water Resources Department. Most of the villages in the coastal areas are covered by local sirens and loudspeakers controlled by the district office to announce news and other information. TMD plans to automate activation of these local sirens when the warning towers are activated. NDWC has developed the SOP in collaboration with international organizations such as IOC, Pacific Disaster Center, and Japan Meteorological Agency for warning dissemination.

The Provincial Radio Broadcasting Centers will be used as a hub to disseminate warnings from provincial to village level for building in redundancy in the system. Municipality and provincial authorities are contacted during any emergency through the DDPM/DOPA radio network frequency. The Provincial Civil Defense Office plays a crucial role in the dissemination of warnings to the district offices upon receipt of a warning message using leased lines, while the districts use telephone and mobile phones to disseminate the warning to sub-districts. The delivery of warnings takes 15 to 20 minutes from the provincial level to the community. The Tambon Administrative Office (TAO) acts as the link between the districts and the community or villages and warnings are relayed to warning sirens installed in villages through telephones. Since NDWC also disseminates warning information to the media, people along the coast receive warnings first through the media, which is reinforced by these other channels. NDWC has also planned to connect Provincial Radio Broadcasting Centers using the Asia Star Satellite to send warnings to the community quickly and make the system more robust.

The DOPA has robust HF Radio and trunk radio communication systems to connect the provincial, district, and local levels with the central command system of the Interior Ministry, and with other stakeholders as necessary. During disasters, DOPA receives information from both NDWC and TMD, and then verifies information before dissemination by its 24/7 Communication Unit through radio, telephone, fax, and text message to the provincial governor, who acts as a focal point for subsequent actions.

Standard Operating Procedures to ensure that warnings reach the last communities are being developed by NDWC and DDPM in collaboration with all relevant stakeholders. In a nut-shell, a redundant communication system exists from the national to provincial levels, and in some cases down to the districts, but linkages from there to the community are weaker.

The Radio Amateur Society played an important role during the tsunami by developing a HAM (amateur) radio and Citizen Band radio communication system. But the CB/HAM networks are not well-planned, although the HAM Radio over Internet Product (RoIP) can cover virtually the whole country. The frequency arrangements and control centers are not identified. Also there is no assigned representative that will stand by for emergencies.

2.2.3 PUBLIC AWARENESS OF EARLY WARNING SYSTEMS

There is some understanding and awareness of EWS due to the extensive media coverage of installation of the high-tech siren towers along the tsunami-affected coastline. Interviews with the community and TAO indicate that an awareness campaign is needed in areas where sirens are situated since communities respond to the warnings, even if they cannot distinguish between the different warning tones of the siren. The budget for these training and evacuation drills has already been allocated to TAOs.

Awareness activities in vulnerable areas are carried out by many stakeholders, such as the DDPM and NDWC. NDWC carries out these activities through other agencies such as the adaptive learning and knowledge-based capacity development program supported by IOC and UNDP in six vulnerable provinces. DDPM conducts a few courses to train people in collaboration with the German Agency for Technical Cooperation (GTZ) and Japan International Cooperation Agency (JICA), covering early warning systems, provincial evacuation plans, drills, capacity building of local authorities, as well as public awareness and education. DMR carries out awareness activities at the local levels on landslides and geohazards such as sinkholes, but with a very sparse coverage due to inadequate staff. There is some public education, but not a concerted effort targeting all the vulnerable communities.

2.2.4 RESOURCES AND PLAN FOR COORDINATION OF RELIEF EFFORTS

The main actors at the provincial and district levels during any emergency are Provincial Governors and District Chief Officers, who are officials under the Ministry of Interior. They coordinate disaster relief activities of various government agencies, both civilian and military, as well as the NGOs and private sector involved in the response. The Governor as Provincial Civil Defense Director and the District Chief Officer as District Civil Defense Director are authorized under the Civil Defense Act 1979 to mobilize all necessary public and private resources for response during times of emergency, except the military. To mobilize military resources for disaster response, the Civil Defense Director requests the commander of the military unit stationed in the provincial jurisdiction for assistance, and usually the military cooperates readily with the province, districts, or municipalities.

The governor is also authorized to use the emergency funds of up to 50 million baht (USD 1.3 million) for the response and relief efforts. The provincial administration under the Governor is currently supported by DDPM staff. In the near future, an NDWC mobile unit consisting of one senior staff and three mid-level staff, with the necessary equipment and skills, will be available for immediate deployment to an affected province. The District Administration Office and the Tambon Administration Office can utilize the resources at their disposal for emergency relief or response, based on a declaration of disaster by the Provincial Governor. They also have a dedicated budget for any training or capacity building at their levels. The Ministry of Interior has directed DDPM to set up the One Tambon One Search and Rescue Teams (OTOS) and to train each team comprising of 15-20 members/volunteers on search and rescue. The OTOS was initiated in 2005 to cover around 7,254 Tambons (sub-districts) by 2009. The budget to implement the plan comes from both the government's annual budget and provincial CEO budget.

As per the Civil Defense Act of 1979, provinces, districts, and municipalities have to formulate civil Defense plans and conduct exercises. The Ministry of Interior has also written to the governors to ensure two exercises each year for man-made and natural disasters in each province and one exercise each year in each district, which is treated as a key performance index. The provincial exercises are supported by the DDPM, but there is no budget for the district level exercises, for which DDPM persuades release of the provincial CEO budget. As per the law, the National Civil Defense Plan is to be updated every three years. The plan encompasses both natural and man-made disasters. DDPM acts as a secretariat of the National Civil Defense Committee, with 10 sub-committees, one for each hazard, e.g. the building code development committee, which includes the Department of Public Works and Town Planning. For the Strategic National Action Plan (SNAP), over 40 agencies have been consulted, and the draft has been prepared based on their inputs. This is to be finalized at a workshop later this year.

DoPA has an operational center at the national level which coordinates with DoLA, provincial DDPMs, districts, and sub-districts. DDPM has its operation center at national and regional levels. Each governor has an emergency operation center (EOC) at provincial level, but they do not operate around the clock. The NDWC control center operates continuously but is focused on early warning. TMD control rooms also monitor the data network and weather information for early warning.

2.2.5 RESOURCES AND PLAN FOR COORDINATION OF RECOVERY EFFORTS

Recovery efforts are led by the Provincial Governor at the provinces who coordinates all the related departments and agencies. These agencies also maintain their reporting lines to their respective ministries. There is no one central agency that coordinates recovery, unlike in most of the other tsunami-affected countries; hence, the recovery efforts are entirely sectoral.

In a recent incident of flooding in many provinces, the central government instructed the affected provinces to ensure recovery activities are completed within three months, and also that financial allocations will be made only after a one-month planning exercise involving all relevant agencies at the local levels to ensure that these efforts are all well-integrated and not duplicative. In the interim, DDPM has requested that the ministries be permitted to use their own funds to effect urgent repairs and restore links.

Rehabilitation of damaged public utilities and the victims' livelihoods and necessities are the coordination responsibility of the DDPM. The recovery efforts are actually carried out by the relevant technical and sectoral agencies. In its strategy document, DDPM prioritized effective damage assessment through remote sensing; greater involvement of the private sector, NGOs, and communities; and speedier return to normalcy through livelihood restoration activities such as community development and vocational training.

2.3 FINANCIAL RESOURCES

2.3.1 ALLOCATION OF RESOURCES

NDWC has a budget of about USD 7 million for the 2006 fiscal year, and a planned budget of USD 4 million for next year. The DDPM budget for 2006 was around USD 60 million, which is nearly double the allocation before the tsunami. Some of the other support agencies such as the DMR lack resources, especially human.

Resources are also available at the provincial level through central allocations and the CEO budget. The District and Tambon Administration Organizations receive funds from the province (and DOLA) both for development activities and specific disaster preparedness, mitigation, and capacity development activities. The recently introduced One Tambon One Search and Rescue Team (OTOS) is funded from all of these sources.

2.3.2 EMERGENCY NATIONAL FUND

While there is no national emergency fund, at the provincial level a reserved fund of 50 million baht (USD 1.3 million) is available with each governor for immediate relief or response activities in accordance with the Ministry of Finance Regulations on Reserved Fund for Disaster Emergency Victims, B.E. 2546 (2003). Any additional resources required can also be allocated from the provincial budget by the governor. A much smaller amount is available with the districts and sub-districts for response or relief activities, which can be used with approval by the governor's office.

2.3.3 EMERGENCY FOOD RESERVES

There are no emergency food reserves, but the reserved fund described above can be used to provide any relief assistance in the form of food, drinking water, and so on as approved by the provincial governor.

2.3.4 UPKEEP OF EMERGENCY EQUIPMENT

The budget for maintenance of emergency equipment is part of the central allocations and also available with the local administration, which is in charge of the equipment.

2.3.5 PROCUREMENT PROCEDURES

The Regulations on Reserved Fund, B.E. 2546 (2003) provides all the procedures that can be adopted for an emergency. It also identifies procedures by which any additional funds necessary can be obtained either from the DDPM budget, the Ministry of Interior, and even the Prime Minister's Office if the magnitude of disaster warrants such an intervention.

2.4 OTHER CRITERIA: WORK CULTURE, INTEGRATION OF GOVERNMENT LEVELS

The administrative system for disaster management is well-integrated with overall administration at all levels. Except for the recently created NDWC, no new structures were established for the tsunami response, recovery, or longer-term disaster management. There appears to be greater cooperation of government agencies with DDPM than with NDWC, which is to be expected because the latter is relatively new and still awaiting legislation to support its establishment.

While the work culture is professional and accountable, it appears that information is not always shared fully and there is some competition between agencies. Decisions have to be referred back to the highest level within various ministries and departments, perhaps due to the well-established hierarchies within. Organizational interests appear to preclude cooperation at the lower levels and foster unhealthy competition.

3. MILITARY AND POLICE

In Thailand, both the military and the police perform emergency-related tasks, as part of the National Security Council and the National Civil Defense Committee. They also come into the picture at the provincial and the local levels when the Provincial Governor brings them into action in a disaster situation. Even in the 2004 tsunami, the military forces played a crucial role in the search and rescue efforts.

While militaries traditionally provide emergency response support, a notable difference from the militaries of other tsunami-affected countries is that the Hydrographic Department of the Royal Thai Navy also provides tsunami observation support through its sea-level monitoring stations. In fact till 1962, this department of the Royal Thai Navy also handled meteorological observations. The information provided to TMD and NDWC by the Hydrographic Department is one of the determinants in issuing a tsunami warning.

After the tsunami, the strong engineering corps in the army was put to good use in building temporary shelters and even permanent housing for the affected communities. The National Civil Defense Plan and the corresponding plans at the subsidiary levels clearly identify the roles of the military in an emergency situation, which is to play a supporting role to the administration in activities such as search and rescue, coordination, and communication support. The military also have their plans and drills, which are routinely practiced. There are joint drills involving all relevant actors such as the DDPM, local response units, and sections of the army, navy, and the air force as mandated under the civil defense plans. The resources that the military brings in, such as the equipment and skilled personnel for communications, earthmoving, bridging, emergency water purification, and search and rescue, are all available with relevant agencies for coordination. DDPM, as the national level agency responsible for emergency response, is aware of these skills and resources that the military can bring and hence they are well utilized.

The Thai military has longstanding relationships with other friendly militaries, and this resulted in quick mobilization of the necessary technical assistance for search and rescue and the disaster victims' identification after the tsunami.

The National Police Department has fire brigades under its jurisdiction and plays a major role in emergency response. Except in the Bangkok Metropolitan Authority area, where there is a separate unit for emergency relief and response called the Civil Emergency Relief Department (CERD), fire brigades under the police assist the local emergency responders. Volunteer teams and the DDPM's local units are involved in immediate response activities. The police teams facilitated collection of DNA to identify missing people after the 2004 tsunami. In short, the military and the police are well integrated in the emergency plans of the nation and have the necessary capacities and resources.

4. NGOS AND CIVIL SOCIETY

Realizing the magnitude of the tsunami disaster, the Thai civil society contributed generously by donating cash, clothing, blood, and bottled water, as well as by providing meals at crisis centers. Thai volunteers poured in to help in the search and rescue operation, working in the mortuaries, cooking, and distributing food, water, and clothes to the displaced. There was also an influx of NGOs to carry out disaster relief activities—the media estimates that within two weeks of the tsunami there were over 100 NGOs working in the affected areas of Thailand and almost 300 government entities involved. Most of the NGOs were involved in emergency response/relief activities and some in recovery. Due to the large numbers of foreign nationals who were affected in the disaster, international private rescue teams also came in to assist the local authorities.

Traditionally NGOs in Thailand have been working on health, literacy, livelihood enhancement, or human development, and mostly in rural areas and very few urban settlements. Only in the later part of 1980s did NGOs focus on the environmental aspects of development and with it the seasonal floods and landslides. Much of the spontaneous support after the periodic floods and other disasters focused on the emergency relief and response requirements.

The government had announced that it was only looking for technical assistance from international agencies and other well-wishers. Despite this, in the aftermath of the tsunami, like other countries Thailand had its share of problems in dealing with the massive support pouring into affected areas from both within and outside the country. One of the major issues was dealing with the registration process for the dozens of new organizations wanting to contribute to the local efforts. Without these procedures being transparent, there was confusion everywhere. Many of the groups were unable to register and therefore operate legally and receive the tax benefits and privileges available to registered organizations. Many of these agencies were functioning without the benefit of local employees, or they were carrying out their activities in an uncoordinated manner and could not be monitored, resulting in duplication and biased distribution of aid[1].

One of the major NGOs working in the area of disaster management is the Thai Red Cross Society (TRCS) whose involvement is from preparedness to response and relief in collaboration with both domestic and international agencies. In the tsunami, the TRCS assisted in the delivery of public donations to affected communities. They were inundated with in-kind donations and established relief centers. TRCS coordinated well with provincial authorities and had free access to Thai Air Force transport for supplies and personnel. The TRCS has set up a communication center that links with the NDWC, Ministry of Interior, BMA, the police, army, TMD, DDPM, and others via VHF and radio system. Mostly it works in a passive mode (receiving information from other agencies). Depending on the severity of the event, the TRCS Secretary General brings into action the two Red Cross hospitals and the Youth and Volunteer Bureau. In an emergency, the disaster operation center works around the clock. It first establishes contact with the provincial Red Cross chapter (chaired by the spouse of the Provincial Governor in her/his capacity of an honorary volunteer), which immediately conducts an initial assessment. There is also a provincial plan for disaster management and a committee under it, also chaired by the spouse of the provincial governor. TRCS responds accordingly, assisting with food, water, and drug distribution through its modest network of volunteers.

The TRCS has relief teams, but does not conduct rescues, which are carried out by DDPM and the local authorities. During a large-scale disaster, logistics are initiated from the provincial level (assisted by the central level if necessary) through the district branches to the community level (via TRCS volunteers). The central level provides relief kits and caters to specific requests from DDPM, such as

[1] IDRL

for flat-bottom boats and medical teams to support the victims. In addition, TRCS also collaborates with private organizations such as Narenthorn Health Relief, Ruam Ka Tan Yu, and Chinese Overseas Rescue to avoid duplication. The central government works with TRCS via the Secretary General. Since the chairperson of the TRCS in each provincial chapter is the governor's spouse, their response is quite well-coordinated and in collaboration with the local government administration.

Of late, TRCS has commenced a few pilot projects focusing on community-based disaster risk management (CBDRM) with support from the International Federation of the Red Cross and Red Crescent Societies (IFRC) and training from ADPC. But these programs have very limited coverage considering the areas that are vulnerable. NDWC, DDPM, and ADPC, with UNDP support, have also commenced CBDRM activities in the most vulnerable areas of coastal Thailand. Of the few NGOs (national and international) working in this area, DDPM has a close working relation with most of them; networking and coordination meetings are organized regularly by DDPM. The Royal Secretary and all Foundations under the Royal Family provide support on an *ad hoc* basic in emergency situations.

However, there are not many civil society actors and NGOs active in the area of disaster preparedness and NGO involvement is very weak. This is because Thailand is not a very disaster-prone country. Their involvement in local-level disaster preparedness has great scope for being up-scaled.

5. CURRENT SYSTEM CAPACITY

5.1 EARLY WARNING

With a dedicated organization for early warning, and lot of investment into improving the observation, generation, and dissemination of early warnings, Thailand's early warning systems have improved tremendously. The analog observation equipment at the Hydrographic Department of the Royal Thai Navy and the TMD are also being upgraded in phases. Additional seismic stations are also being established and communication links between the technical agencies and the NDWC improved.

There are over 100 towers installed along the vulnerable coastline in the south, and many more planned in the areas prone to floods and landslides in the north. These towers can be activated remotely and will also be able to broadcast warning information in five languages considering the foreign tourists. The same warning is communicated through multiple channels such as loud speakers, SMS, radio, telephone, faxes, TV, and news media simultaneously to ensure redundancy, reach into remotest areas, and clarity of the information.

Public education and awareness activities are ongoing side by side with the development of emergency plans, evacuation routes, and safe areas. Awareness materials are also being designed, such as tsunami evacuation maps and guidelines for action after a warning is given. Further activities are being undertaken to ensure that the Provincial Governors and the local administration organizations can play the roles expected of them once a warning reaches them from the national level.

5.2 OVERALL DISASTER READINESS

5.2.1 THE NATIONAL DISASTER MANAGEMENT ORGANIZATION(S)

The DDPM has received more funding in the last couple of years compared to before the tsunami. It has also been tasked with creating a pool of over a million volunteers. Its own staffing situation has improved and more recruitment is planned at its local provincial units. The training academy it has established is serving to train its own officials initially, and then the other government and non-government stakeholders will benefit. The emergency plans mandated under the Civil Defense Plan are also being prepared and updated. Awareness and public education activities are also being undertaken on a large scale. Mitigation activities of the agency appear to have taken a backseat to the preparedness activities. The National Security council has been developing the National Crisis Management Center (NCMC), which is not yet approved. DDPM needs to ensure that its collaboration with the sectoral ministries continues, and that changes to policies such as incorporation of disaster risk reduction into development planning are addressed simultaneously.

NDWC, which was in a very dominant position under the previous administration, is awaiting clarity on its responsibilities. Some of its activities such as installation of the remaining siren towers are being put on hold in the absence of explicit support from the current administration. However even in the past year or so, it has achieved much and is well placed to build upon its vantage position. Presently it is focused on the tsunami warnings only but has the capacity and willingness to expand its warning systems to cover other more frequent hazards like floods and landslides. In this it will require even greater support from technical departments such as the TMD, DMR, and others, and needs to proceed slowly to win their trust and confidence.

5.2.2 OTHER MINISTRIES

The various departments and ministries responsible are well coordinated under the umbrella of the Civil Defense Plan in which their roles are spelled out. Individual agencies and ministries will prepare

detailed plans accordingly. The health sector preparedness for emergencies was seen in a good light in the tsunami response—many of the international teams that came in found that they had no work, as all necessary steps and precautions had already been taken by the national and local health authorities.

But other than the mainline ministries, the incorporation of risk reduction in routine development activities on a sustained basis is still only beginning.

5.2.3 MILITARY

The roles and responsibilities of the military are spelled out in the Civil Defense Plan at various levels, and it is well integrated in the response systems. It is under the coordination of the relevant civil defense directors.

5.2.4 NGOS AND CIVIL SOCIETY

Involvement of NGOs and civil society in emergencies is growing stronger after the tsunami, where they played a substantial role. Humanitarian assistance to migrants excluded from the national relief efforts was initially provided through NGOs. NGOs are primarily involved in the response or relief operations and, to an extent, in the preparedness. One of the major players is the TRCS.

The Ministry of Interior has also assigned DDPM to train at least 2% of the population, or around 1.2 million volunteers. Consequently, the DDPM has to collaborate with NGOs such as the Thai Red Cross Society, especially for CBDRM activities.

Collaboration of the government agencies with this sector needs to increase if the vulnerable populations in all the provinces are to be reached soon.

5.3 RECOVERY AND RECONSTRUCTION

5.3.1 DATA COLLECTION ON DAMAGE AND NEEDS

Each line ministry has collected data relating to the damages and needs in its relevant sector, and there is no dearth of data. Fortunately the damage to public infrastructure was not that great in comparison with the other affected countries.

As in all countries, there was insufficient baseline data to start with, especially regarding boats, some of which were not registered. The same was true of migrant workers who would not register. There was no centralized database available for all the ministries to share and create a more comprehensive and customized recovery program.

5.3.2 STAKEHOLDER INVOLVEMENT AND PARTICIPATION

Much of the tsunami response and even the recovery was strongly driven by the national government aiming to get things back on track as soon as possible, in the process sacrificing the people's participation and ownership. The Community Organizations Development Institute (CODI) reporting to a committee under the Ministry of Human Security and Social Development facilitated community involvement, especially in housing and livelihood restoration projects, through local seminars and public booths to collect and disseminate information.

The communities felt they were not adequately consulted especially for the housing programs, which resulted in many of them rebuilding *in-situ* with their own resources. All the sectoral agencies are collaborating with the DDPM to ensure that the recovery program is completed.

In restoration of coastal environment, different departments have mandates for their respective areas, sometimes creating conflicts and overlaps.

5.3.3 COASTAL COMMUNITY RESILIENCE

The Coastal Zone Management Act is still under development while various committees are working on reviewing the current marine and ocean policies. While the ocean policy is in draft stage, there

are at least twenty pieces of legislation, with the earliest one almost a hundred years old that governs the administration of coastal areas. Harmonizing these policies and legislation will take a while, and the Department of Marine and Coastal Resources (DMCR) is collaborating with the Ministry of Policy Planning on some of this work.

DMCR setbacks for building and construction activities was initially proposed to be 100 meters. It was reduced to 50 meters and then to 30 meters; currently setbacks are not strongly enforced. The DPT also provided guidelines for future land use in affected areas, which were not enforced by the law. DPT initially indicated the risk areas (such as flood-prone and tsunami-prone) so it designed for new constructions in areas safe from these risks. The government provided financial assistance to build new houses in safe areas in collaboration with the military. However, if local people insisted on living in their original sites that were not in the safe zones, they have had to build their houses on their own without any assistance by the government. DMCR feels that the natural resources in the form of green belts, coral reefs, seagrasses, mangroves, and other coastal vegetation all contribute towards reducing risks and helping to protect against coastal hazards. In the tsunami, there was not a great deal of damage to the mangroves (less than 1% damage), hence reforestation and replanting is not a problem. In the same go, DMCR is trying to rehabilitate the encroachment areas too.

The Ministry of Environment has Environment Officers at the provinces responsible for all areas under the subject of environment, and since there are no representatives of DMCR at the provinces, it works through these Provincial Environment Officers, most of whom have a forestry background. There is an on-going Swedish International Development Cooperation Agency (SIDA) project in collaboration with the Ministry of Policy Planning to develop coastal setback guidelines. Community-based natural resources management is being advocated and practiced by the DMCR through the Phuket Marine Biological Center and three other such centers.

5.3.4 BUILDING BACK BETTER

There is definitely a conscious attempt to build back better in Thailand. This is reflected in the revisions brought about in the building codes in the local administrations, the introduction of the setback regulations, and in the quality of the houses reconstructed. Whether this percolates from recovery into development however, remains to be seen.

5.3.5 TRANSPARENCY IN BENEFITS AND ENTITLEMENTS

The policies relating to benefits for the survivors and the affected population for the tsunami are widely known. However, there is a perception among sections of the international community that the monitoring and oversight of the assistance available could have been better. There were very few formal mechanisms for registering or addressing grievances at various levels.

6. SUMMARY AND RECOMMENDATIONS

6.1 STRENGTHS

Considering that disasters are not very frequent nor very damaging in Thailand, the disaster management systems possess a number of strong points:

1. The Thai economy is strong and the resilience is quite high. The government was able to decline international financial assistance and still manage the tsunami response and recovery effectively and efficiently.
2. Investments on technical infrastructure for early warning and communication are easily forthcoming. The systems in place even before the tsunami were quite robust, and with the added impetus the technical systems are getting even better.
3. The various agencies and ministries with a stake in disaster management are strong and well-resourced. The roles of various stakeholders are clearly delineated per the Civil Defense Act up to the local levels. There is no or little ambiguity.
4. The Strategic National Action Planning (SNAP) as per the Hyogo Framework of 2005 is an attempt to integrate the actions of over 40 stakeholders and is a step in the right direction.

6.2 WEAKNESSES

1. The integration of the policies, plans, and priorities of different ministries and departments towards risk reduction is still missing. The Civil Defense Plan, while quite detailed, is more focused on response or preparedness for response measures.
2. The NDWC, though only over a year old, has made great progress and a lot of investment has already gone into developing an early warning system. With the recent change in the government, it is awaiting indications of support and continuity of policies. Without a legal basis, its long-term support appears shaky and will not be able to sustain the level of cooperation it requires from the various other agencies to effectively carry out its mandate.
3. An inadequate level of coordination and constraints on information sharing within the inter-governmental agencies results in many unutilized or under-utilized resources for risk reduction in the country.
4. Relationships between the media and the NDMOs could be better. Media tends to mistrust the warning providers, while the NDWC is a skeptical about the media's ability to assist.
5. There is a lack of adequate trained human resources for disaster management probably because disasters are not a common phenomenon in Thailand,

6.3 RECOMMENDATIONS

1. The government of Thailand needs to ensure that an adequate number of volunteers are trained properly on disaster response measures. The OTOS concept will need intensive efforts over the next few years. Technical assistance through training of trainers from international agencies and countries will help make this a reality.
2. The government needs to support contingency initiatives among and between telecommunication providers and NDMOs to enhance redundancy and safety. Though the

communication system in the country is robust, with multiple redundancies, regular drills are required to verify its functionality and to provide live training for involved staff.

3. The NDWC and other agencies need to develop a comprehensive protocol and set of procedures to disseminate warnings. There is also a need to set up a functional feedback mechanism that links the government to the various stakeholders at the national, provincial, and local levels. The legal establishment and permanent staffing of these agencies should be resolved as soon as possible.

4. The overlapping of mandate among the two key agencies needs to be clarified. The NDWC and the DDPM need to coordinate their efforts and clarify which agency does what in very explicit terms to minimize overlaps and duplication at the national level.

ANNEX A: MATRIX FOR THAILAND

1. Policy, Legislative and Institutional Environment

Criteria	Development Stage Indicators			
	1	2	3	4
Legislative Environment for DM	Does not exist	Based on cabinet paper or circular or directive	Legislation under development	Approved legislation exists
Institutional Environment	No formal institutions	Formal institutional framework only on paper	Institutional framework present but insufficient (Overlaps and duplication)	Roles and responsibilities of each institution involved in DM vis-à-vis others is written down, well understood and used
Political environment	No observable political will	Political commitment vocal but no actions yet	Strong political will and some but insufficient action.	Significant political support and commitment to DM available
Policies relating to Disaster Management(DM)	No or outdated DM policies	New policies prepared but not yet comprehensive or approved	Comprehensive policies exist but not yet fully exercised	Approved policy exists; adequately covers a broad spectrum of activities from response to recovery to mitigation and encourages incorporation of DM concerns into normal development
Policy Formulation	By fiat or not undertaken	Several but not all government stakeholders involved	Inclusive of government entities; insufficient in civil society and/or military involvement and acceptance	Thoroughly consultative; adequate opportunities for involvement of all stakeholders; feedback sought and received
Policy supports disaster management at all government levels	Only central government involved	Central and province level government involved	Full authority granted at all levels except community	Provides for and supports decentralization of DM to all levels
Involvement of various other government stakeholders	Only one central entity involved	Only main line ministries involved	Includes some the other necessary Ministries: health, agriculture, local government	Actively encourages comprehensive involvement; addresses cross-cutting concerns of DM within various sectors

Criteria	Development Stage Indicators			
	1	2	3	4
Linkages with other government policies	No official methods of linking	Linkages on paper only	Links in place but not fully utilized	Explicitly identifies links to DM in existing policies and ordinances
	Only in DM policies	Others weakly/insufficiently engaged	Good for mainline ministries but not comprehensive	Risk reduction concerns explicit in relevant policies, regulations, e.g. land use planning, etc.

2. National Disaster Management Office (NDMO)—Department of Disaster Preparedness and Mitigation

Criteria	Development Stage Indicators			
	1	2	3	4
A. Mandate				
NDMO goals and objective statements	No statements exist	Written goal statements but inadequate/ outdated	Goals clear to government only; not comprehensive	Covers all aspects of disaster management including incorporation of DRR in development
NDMO mandate recognized and accepted by others in and outside of government	Nobody recognizes mandate/authority outside NDMO	Recognized only in mainline ministries/not fully accepted	Recognized by essential ministries but not known to public/local governments	Mandate of NDMO well-recognized and accepted by all other stakeholders, who agree to its coordinating role.
Institutional Structures	Not considered	Systems in place only for mainline ministries	Systems operative throughout central government; weak elsewhere; (roles and responsibilities unclear)	Operational roles/responsibilities with other DM organizations well laid-out and effective
Administrative Structures—for decision making	No such structures yet in place; timely response unlikely	Beginning to address issues; timely response still uncertain	Reporting/decision lines unclear and/or waivers not adequately stated.	Administrative structures, waivers, etc. exist to provide rapid response and support to cut through bureaucracy
Administrative Structures—for coordination	-do-	-do-	-do-	-do-
Administrative Structures—for delegation of authority	-do-	-do-	-do-	Direct reporting to the highest level
Administrative Structures—for timely response	System contains too many lag points; not responsive	Warnings timely at HQ, next steps unclear	Warnings reach provinces in timely fashion but forwarding warnings to users is slow	Warnings delivered and received at all levels; no lag time in response
Political environment	Does not exist	Much political jockeying slows things down	Necessary support generally but not always available	All necessary support available
B. Disaster Management Capacities				
i. Technical and Human Resources				
Staffing	Inadequate: untrained and/or high turnover; duties unclear	Marginally adequate: few trained/experienced professionals; high turnover	Keep trained staff but need more training and support staff	Fully staffed with plans and resources for skills development through training etc.
Resources and plan for communication of early warnings	Not thought through nor purchased	Plans, but inadequate. Equipment inadequate. No public awareness	Both plans and equipment in place but untested. Insufficient public awareness	Redundant communications gear to ensure rapid dispersal of early warning information
Public awareness of early warning systems	Need not recognized	Education planned but not done	Some public education	Widespread understanding

Criteria	Development Stage Indicators			
	1	2	3	4
Resources and plan for response coordination at all levels	Not in place	On paper but under staffed/untrained	Somewhat operative at national level; other levels lack adequate training and equipment.	Fully functional command/ operations center, with necessary technical skills and human resources exists- 24/7; good surge capacity at anytime.
Resources and plan for coordination of relief efforts	Not yet undertaken	Plan exists but excludes donors, entities	Well planned and resourced but no coordination capacity with civil/private sector (NGOs, etc)	Procedures, plans and resources available for coordination; well understood, accepted, and used by all stakeholders
Resources and plan for coordination of recovery efforts	Not in place; recovery efforts uncoordinated and unequally applied	In place; does not include all ministries (agriculture, health, etc) in planning recovery	All requisite host government agencies in place but foreign recovery programs not aligned	Full recovery effort, including all players, planned and coordinated to ensure adequate coverage of disaster area and appropriate use of materials, labor, etc.
Resources and plan to ensure recovery efforts support development goals of nation	Not yet considered	Exists only in mainline ministries; no civil society input planned.	Includes all relevant government ministries but excludes non-government responders	All recovery efforts are weighed and approved against long-term development effects; private sector responders in complete accord.
ii. Financial Resources				
Allocation of resources	All resources donor-dependent	Budget funded but insufficient	Funding remains subject to political/economic pressures on government	Commensurate with mandate and covers all phases of the DM cycle, including development
National Disaster Fund	Does not exist	N/A	Exists but not adequate nor protected	Fund put aside to be used in the event of a disaster; established procedures for compensation, relief support exists
Emergency food reserves	-do-	-do-	-do-	-do-
Allocation for maintenance and routine upkeep of all emergency/relief equipment	Does not exist	Being put in place but money is scarce; donors do not provide	Some donors provide; inadequately protected or misused	Exists; donors expect to provide along with donated equipment
Procurement procedures	Chaotic	Work only with high-level involvement	Work in normal (but not extreme) disaster situations	Crisis procedures exist which can fast-track any necessary procurement of services or goods

Criteria	Development Stage Indicators			
	1	2	3	4
C. Other Criteria				
DM functions exist at all levels of government	Exist only at the Center	Exist only at the Center and Provinces (districts)	Exist but does not function at all levels	Branches of NDMO/DM institutions exist and function at all decentralized administrative levels
Work Culture	Information not shared; secretive and competitive environment (NDMO shares, not others)	Clear lines of authority but too high level and authoritarian	Culture adapts to emergency response readily and efficiently; other facets of DM still too non-collaborative.	Participatory, consultative to authoritative, appropriate to the phase of disaster management

3. Related Ministries/Departments/Institutions

Criteria	Development Stage Indicators			
	1	2	3	4
Development Activities	Risks not considered in other ministry planning	Only 1-2 ministries consider risk in development planning	All ministries are cognizant of risk in their planning	Development activities take into consideration disaster risks
Enforcement of guidelines, policies and legislation	Not enforced	Some enforcement, but erratic	Good enforcement but limited by lack of funds/staff	Enforce existing policies/ guidelines/ regulations that address disaster risk concerns
Collaboration	Do not work with NDMO	Meet very rarely with NDMO	Regular meetings held but not decision-making	Collaboration with DM agencies is well established
Recovery & Reconstruction	No concept	Concept exists but not backed by capacity	Concept, skills and capacity exists but not backed by resources	Building back better is ingrained in work culture; necessary knowledge, resources and skills available
Disaster Preparedness	No plans or procedures exist	Some plans and procedures in place but rarely updated	Plans, procedures exist but cannot be applied due to some constraints	Contingency plans and operating procedures exist, guide actions after a disaster, and are reviewed and updated regularly

4. Military/Police

Criteria	Development Stage Indicators			
	1	2	3	4
Involvement in disaster management planning	Have their own plan, uncoordinated	Basic MOU on planning responsibilities, no follow-up	NDMO and military coordinate disaster planning; do not include other responders	Full range of responders involved in planning.
Involvement in disaster response	Ad hoc, involves only military	Roles and responsibilities beginning to be spelled out with NDMO	NDMO and military roles clear; other responders not informed	Full range of responders are involved in or aware of disaster plans.
Clarity of coordination	None	Military coordination limited to military	NDMO and military coordinate; others excluded	Full range of responders coordinate frequently and actively
Clarity of command/control functions	Clear only in military	Clear in military and NDMO, but not vis-à-vis each other	Joint understanding of command control between NDMO and military only	Full range of responders understands and is trained in command and control scenario
Resources, including relief goods, transport, communications	No stockpiles	NDMO stockpiles some relief goods, as does military	NDMO/ military share electronic inventory of goods and equipment but NGO/donors not included	Assets brought by each player fully understood and stockpiled with electronic records
Training	None other than normal military	Officers trained	Wide military training in response	All training coordinated with NDMO
Response Time	Unknown; no (joint) drills held	Some players drilled and response time slow	Joint response training; drills show good response	Response training offered to all players and at all levels; rapid response time (72 hours)
Capacity	No resources or trained personnel available for disaster response	Inadequate resources or trained personnel available for disaster response	Resources or trained personnel available for disaster response but delays in deployment	Adequate resources and trained personnel available for deployment at short notice
Foreign assistance (if permitted)	No procedures for dealing with foreign military			Procedures exist for coordinating with foreign military personnel deployed for humanitarian disaster response activities
Early warning communication	Communication systems are restricted to military/ police use	Communications systems used but do not link with other civilian systems	Procedures and plans for use of communication systems for disseminating warnings are in place but do not dovetail with national/ local preparedness & response plans	Procedures and plans for use of communication systems for disseminating warnings are in place and dovetail with national/ local preparedness & response plans

5. NGOs/IOs/Civil Society

Criteria	Development Stage Indicators			
	1	2	3	4
Involvement in disaster management planning	Have their own plans, uncoordinated with government or other NGOs	Some civil society organizations coordinate with each other	Some civil society organizations and government coordinate disaster planning; do not include other responders	Full range of responders involved in planning.
Involvement in disaster response	Ad hoc, depending on donors	Organization mandates relief work but not specific skill sets	Organizational mandate supported by trained personnel and resources are insufficient	Organizational mandate supported by trained personnel and required resources
Clarity of coordination in disaster response	Have their own plans, uncoordinated with government or other NGOs	Some civil society organizations coordinate with each other	Some civil society organizations and government coordinate disaster planning; do not include other responders	Full range of responders coordinate frequently and actively
Resources, including relief goods, transport, communications	No stockpiles	Some civil society organizations stockpiles relief goods	NGO/donors share inventory but not coordinated with the government	Assets brought by each player fully understood and stockpiled with electronic records

6. Current System Capacity

Criteria	Development Stage Indicators			
	1	2	3	4
A. Early Warning *				
End-to-End Warning	Warning is held up at the central level	Warnings reach the sub-national level with some delay	Warnings reach users at local level but not promptly	Message gets from Center to village level rapidly
Warning Dissemination Systems	Basic; numerous equipment shortcomings	Developed beyond basic; but equipment shortcomings remain	Advanced, state-of-the-art in some areas; some equipment shortcomings evident	Advanced, state-of-the-art in most areas, no major equipment shortcomings; inter-operability of systems ensured
Comprehension and legitimacy of warnings	Warnings not trusted or understood	Warnings understood but not trusted	Warnings understood and trusted but do not know how to respond	Warning understood and seen as legitimate by local actors and community; response actions are fully comprehended
When warning are issued – clarity of decision making	Basic; no lead from government; no consistency	Intermediate level with lead from government; partly consistent; partly inconsistent	Higher level with lead from government; higher levels of consistency	Advanced, with lead from government, low levels of inconsistency
Extent of EW communication with other stakeholders	Virtually non-existent	Partially developed; many links; much room for improvement.	Well developed, many links exist; dialogue developing well	Fully developed, links with all stakeholders, frequent dialogue
Public awareness raising about warnings	Non-existent or virtually so	Efforts are apparent to develop awareness programs	Programs exist; rely on narrow range of methods; significant shortcomings; not evaluated	Comprehensive; regular awareness raising, using combination of methods; evaluated
Public education about hazard and hazard warnings	Non-existent or virtually so	Efforts to include material in the school curriculum are apparent; other methods are ad-hoc	Embedded in school curriculum; linked to some exposure in audio-visual and printed media; either unevaluated, or special needs and ethnic minorities are distinguished	Integrated approach employing school and college curriculum; audio-visual and printed media; effectiveness formally evaluated; ethnic minority and special-need groups given special attention
Judgment of warning effectiveness by agencies	Denial of failings and limitations; no evaluation	Some recognition of failings and limitations; efforts to identify improvements but little achieved; irregular evaluation	Wider recognition of failing and limitations; some improvements made; evidence of some stakeholder involvement; regular evaluation	Full recognition of failings and limitations in past; improvements demonstrable; regular evaluation involving full range of stakeholders

* Parker, 1999 (Adapted and extracted)

Criteria	Development Stage Indicators			
	1	2	3	4
B. Overall Disaster Readiness				
NDMO	Overall procedures not in place below national level	Center to province in place, untested	Apparent connection top to bottom but untested; some questionable communications gear	Established procedures for passing on EW and declaring state of emergency at both national and sub-national levels exist
	No written system in place	Written system covers only NDMO and military at Center and provinces	Complete written system but not all stakeholders involved	Response measures to be undertaken by all actors upon declaration of an emergency are written down and understood
	No stockpile/ inventory exists	Inventory of stockpiles not automated	Inventory of stockpiles automated, but not updated nor accessible at all levels	Fully automated inventories regularly updated and are accessible at different levels of the administrative structure for deployment in a response
Other Ministries	Have no sense of their role in a disaster	Aware that disasters affect their work but have no sense of mitigation	Some mitigation in their plans but no written role in disaster	Roles clear and practiced, written out
Military	Act separately from NDMO; own chain of command	At cabinet level there is coordination, but not at field level	NDMO and military in full accord up and down levels; insufficient NGO and civil society understanding of mil. role	Fully integrated in government EW and response systems
	Military role unclear, ad hoc	Military has own system in place but not coordinated with NDMO	NDMO and military coordinated, but no public education/NGO understanding	Clear and in legislation and military doctrine
NGOs and Civil Society	Act entirely independently; not part of government planning	Some coordination among private agencies; most not disaster-focused	Clear coordination of disaster-related NGOs, meet with government	Clear roles and responsibilities identified; procedures for registration of new/ international NGOs clear and understood and easy
	Government does not register foreign entities	NGOs are registered; not donor nations; no interface with government on hazards/needs	Relief agencies and government know each other; some joint planning	Established procedures for foreign donor assistance exist along with mechanisms to communicate actual needs

Criteria	Development Stage Indicators			
	1	2	3	4
C. Recovery & Reconstruction				
Data Collection-damages; needs	No coherence in data collection or needs assessment	Some sharing of systems and needs assessments	Coherent system in place, but not used fully to direct reconstruction efforts	Sectoral departments have procedures in place to collect and pass on estimates of damages and needs to NDMO/ agency in charge of recovery and reconstruction
Stakeholders involvement & participation	No involvement	Limited participation	Stakeholders participate but cannot influence decisions	Procedures to consult involve survivors in the recovery and reconstruction efforts are in place; sectoral agencies continue to play important roles with NDMO involved in coordination
Coastal Community Resilience (CCR)	Recovery programs do not consider CCR	NGOs aware and use CCR approach in village level planning	Government and civil society aware and practice CCR in recovery planning	CCR well understood and practiced in all recovery efforts among the coastal communities
Building back better	No concept	Concept exists but not backed by capacity	Concept, skills and capacity exists but not backed by resources	Recovery and reconstruction activities are strongly guided by disaster risk considerations and building back better
Transparency in benefits and entitlements	No transparency	Benefits and compensation packages are known but not the procedures to get at them	Benefits, compensation packages procedures to access them are known but cannot seek redress of grievances (limited redress only)	Affected/ beneficiary lists are transparent; benefits, compensation, and entitlement criteria are in public domain; grievance redress procedures are in place

ANNEX B: THAILAND DISASTER HISTORY (1955-2006)

Dates: Start, End date	Location:	Disaster: Type, Subtype, name	Numbers:	
Jun-55		Wave / Surge Tsunami	500	killed
27-Oct-62		Wind Storm Typhoon Harriet	769 US$19,000	killed ,000 damage
Sep-66	Chiang Rai to Ubon	Flood	6 200 5,000 200,000 US$1,000	killed injured homeless affected ,000 damage
16-Mar-68	Chiang Khan	Misc Accident Misc:Fire	500 US$700	affected ,000 damage
3-Jan-75	South	Flood	239 93 3,000,000 US$45,000	killed injured affected ,000 damage
Oct-77		Epidemic Diarrheal/Enteric Cholera	100 2,800	killed affected
May-78		Wind Storm Storm	50	killed
Aug-78	North, Central, Northeast provinces	Flood	96 400 1,628,000 US$400,000	killed injured affected ,000 damage
Aug-78	North, NorthEast	Flood	400,000	affected
3-Jun-79	Phangnaga	Industrial Accident Ind:Explosion	50 15	killed injured
20-Aug-79	Bangkok	Transport Accident Rail	50 100	killed injured
3-Oct-80	Central, Northeast	Flood	33 631,817 US$59,700	killed affected ,000 damage
16-Nov-80	Bangkok	Industrial Accident Ind:Explosion	38 350	killed injured
6-Jul-81	Nan province	Wind Storm Typhoon Kelly	43,000	affected
Dec-81	South	Wind Storm Storm	55 US$13,000	killed ,000 damage
15-Jul-82	Bangkok	Industrial Accident Ind:Explosion	7 70	killed injured
Aug-83	Bangkok	Flood	50 1,000,000	killed affected
19-Nov-83	Lamlooka district (Pathum province)	Industrial Accident Ind:Collapse Factory	30 50	killed injured
19-Jan-84	Bangkok area	Flood	751,600 US$400,000	affected ,000 damage

Dates: Start, End date	Location:	Disaster: Type, Subtype, name	Numbers:	
Dec-84	Southern, Eastern	Flood	17 31 34,540 3,000	killed injured affected ,000 US$ damage
12-Oct-85	Suan Phung, Damnoen Saduak districts (Ratchaburi province)	Flood	18 7,640 US$3,600	Killed affected ,000 damage
8-May-86	Bangkok, Central, Eastern, Southern	Flood	42 21 27,780 US$2,000	killed injured affected ,000 damage
7-Feb-87	Bangkok	Industrial Accident Ind:Fire Factory	19 6	killed injured
7-May-87	Kanchanaburi	Transport Accident Road	20	killed
30-Nov-87	South	Flood	24 US$7,200	killed ,000 damage
1987	Phuket	Transport Accident Air Boeing 737	83	killed
29-Nov-87		Transport Accident Air Boeing 707	110	killed
10-Apr-88	Chai Nat	Transport Accident Road	50	killed
22-Apr-88	Bangkok	Misc Accident Misc:Explosion	23	killed
20-May-88	Nakhon Sawan province	Transport Accident Rail	27	killed
9-Sep-88	Bangkok	Transport Accident Air Tupolev Tu-134	76 5	killed injured
19-Nov-88 27-Nov-88	Chumphon, Surat Thani, Nakhon Si Thammarat, Phatthalung, Krabi, Songkhla, Yala, Pattani, Ranong, Narathiwat, Satun, Phuket, Trang, Prachuap Khiri Khan provinces	Flood	664 1,878 1,112,941 US$169,146	killed injured affected ,000 damage
8-May-89		Transport Accident Road	21	killed
24-May-89	Lampang	Transport Accident Rail	22	killed
3-Nov-89 5-Nov-89	Chumphon, Nakon Si Thammarat, Phetchaburi, Prachuap Khiri Khan, Ranong, Songkhla, Surat Thani provinces	Wind Storm Typhoon Gay	458 45,000 154,000 US$452,000	killed homeless affected ,000 damage
3-Nov-89	Thailand Gulf	Transport Accident Water Boat 'Seacrest'	91	killed
1-Jul-90	Si Thammarat (Nakhon province)	Transport Accident Road	20	Killed
1-Sep-90		Transport Accident Road	91	Killed
23-Sep-90	Khon Kaen	Transport Accident Water	39	Killed
24-Sep-90	Bangkok	Industrial Accident Ind:Explosion Gas truck	63 97	killed injured

Dates: Start, End date	Location:	Disaster: Type, Subtype, name	Numbers:	
2-Oct-90		Wind Storm Typhoon Ira	36 US$50,000	killed ,000 damage
21-Nov-90	Koh Samui	Transport Accident Air Dash 8-100	38	killed
18-Feb-91	Thung Maphrao (Phang Nga Province)	Misc Accident Misc:Explosion	171 99	killed injured
2-Mar-91	Klong Tory port (Bangkok)	Industrial Accident Ind:Explosion	9 5,000 15,000	killed homeless affected
Mar-91 1991		Drought	2,500,000	Affected
10-Apr-91		Transport Accident Air Army helicopter	14	killed
7-Apr-91	Meiktila	Misc Accident Misc:Fire Market	20	killed
27-May-91	Suphan Buri province	Transport Accident Air Boeing 767	223	killed
Aug-91	Mae Salui and surrounding areas (North)	Flood	16 2,000	killed homeless
17-Aug-91	North and Northeast	Wind Storm Typhoon	38 20 35,407 1,858,811 US$8,323	Killed injured homeless affected ,000 damage
24-Sep-91	Bangkok	Industrial Accident Ind:Explosion	63	Killed
26-Oct-91	Southern coast	Flood	1 100 14,474 US$1,478	killed homeless affected ,000 damage
7-Feb-92	Bangkok	Misc Accident Misc:Collapse Hotel	20	killed
8-Mar-92		Transport Accident Water	112	Killed
5-Mar-92	Bangkok	Industrial Accident Ind:Fire Factory	22	killed
19-May-92		Wind Storm Storm		
16-Oct-92	Koh Samui (Surat Thani province)	Wind Storm Typhoon Angela	3 13,007 93,102	killed homeless affected
17-Oct-92	Sisaket province (North)	Wind Storm Typhoon Colleen	160,550	affected
12-Nov-92	Surat Thani, Krabi, Phang Nga, Nakhon Si Thammarat provinces	Wind Storm Storm Forrest	3 14,113 105,674	killed homeless affected
10-May-93	Puthamonthon (near Bangkok)	Industrial Accident Ind:Fire Factory	211 547	killed injured

Dates: Start, End date	Location:	Disaster: Type, Subtype, name	Numbers:	
3-Jul-93	Bangkok	Industrial Accident Ind:Fire Garments factory	10	killed
11-Jul-93	Nakhon Phanom, Sakon Nakhon, Nong Khai provinces	Wind Storm Storm Lewis	4 60 188,388 US$106,900	Killed homeless affected ,000 damage
13-Aug-93	Nakhon Ratchasima	Misc Accident Misc:Collapse Hotel 'Royal Plaza'	135 270	killed injured
29-Sep-93	Udon Thani, Khon Kaen, Nakhon Panom, Nan, Uttaradit, Phayao, Mae Hong Son	Wind Storm Storm Winona	25,468 US$25,070	affected ,000 damage
31-Oct-93	South	Flood	4 2 613 302,247 US$319,850	Killed injured homeless affected ,000 damage
27-Nov-93 2-Dec-93	Surat Thani, Nakhorn Si Thammarat, Songkla, Pattani provinces	Flood	23 252 16,487 377,070 US$1,261,000	killed injured homeless affected ,000 damage
Dec-93	South	Flood	14 13,228 179,446 US$400,100	killed homeless affected ,000 damage
1993	north, central	Drought		
14-Jan-94		Transport Accident Road	23 20	Killed injured
15-Feb-94	Coast of Ramong	Transport Accident Water	200	killed
3-Apr-95	Prachuap Khiri Khan	Transport Accident Rail	15 109	killed injured
8-May-94	Bangkok	Wind Storm Tropical storm	5,000	affected
Jul-94		Flood	60 59,000 US$238,000	killed homeless ,000 damage
2-Aug-94	North and Central provinces	Flood	9 10,000	Killed affected
30-Aug-94	Bangkok	Misc Accident Misc:Fire	3,000	homeless
25-Sep-94	Wang-Takrai	Wave / Surge Tidal wave	31	killed
21-Oct-94	South	Flood	11 3 3,141 109,113 US$30,000	killed injured homeless affected ,000 damage
14-Jun-95	Bangkok	Transport Accident Water Chao Phraya Express	29 53	killed injured
12-Jul-95	ChiangRai	Earthquake		
9-Aug-95	Bangkok	Wind Storm Tropical storm	27	killed

Dates: Start, End date	Location:	Disaster: Type, Subtype, name	Numbers:	
1-Aug-95 9-Nov-95	Phayao, Pichit, Pitsanuloke, Nakhon Sawan	Flood	231 56,984 4,224,000 US$140,500	killed homeless affected ,000 damage
20-Oct-95	Bangkhen	Misc Accident Misc:Fire Department store	US$32,200	,000 damage
28-Oct-95	Bangkok	Flood	200 2,000 US$400,000	Killed homeless ,000 damage
22-Nov-95	Bangkok	Misc Accident Misc:Fire Department store	4 US$51,400	Killed ,000 damage
18-Jul-96 21-Aug-96	Chumphon, Chiang Rai, Nan, Nong Khai, Udon Thani, Rayong, Ranong	Wind Storm Typhoon Gloria and Frankie	9 343,386	Killed affected
30-Jun-96 22-Oct-96		Flood	91 5,000,000	Killed affected
7-Nov-96	Rayong Province	Industrial Accident Ind:Fire Oil Depot	12 17 33	Killed injured affected
4-Jun-97	Near Lopburi	Transport Accident Road	36	killed
11-Jul-97	Pattaya	Misc Accident Misc:Fire Hotel	90 64 US$10,500	killed injured ,000 damage
19-Aug-97 1-Sep-97	Surat Thani Province	Flood	46 394 50,000 US$39,500	killed injured affected ,000 damage
18-Sep-97	Northeast (4 NE prov. Mekong overflow)	Flood	14	Killed
20-Sep-97	Narathiwat Province	Transport Accident Air Helicopter	14	Killed
24-Nov-97	Tambon Nong Ola Lai (near Phichit)	Transport Accident Road	21 40	killed injured
11-Dec-98	Near Surat Thani	Transport Accident Air Airbus A310-200	101 45	killed injured
Feb-99	Nakorn Si Thammarat, Surat Thani, Songkla Provinces	Flood	3 20,000	killed affected
24-Jul-99 5-Aug-99	Chantaburi, Trad, and Ubol Ratchathani Provinces	Flood	7 90,700	killed affected
Aug-99	Mae Hong Son & Tak Provinces	Flood	862	affected
19-Sep-99	Chiang Mai	Industrial Accident Ind:Explosion Factory	35 100	killed injured
25-Oct-99 9-Nov-99	Prachuap Khiri Khan, Phetchaburi, Ratchaburi, Kanchanaburi, Lop Buri, Phitsanulok, Phichit, Nakhon Sawan, Satun, Phuket	Flood	10 170,000	killed affected
23-Dec-99	Surat Thani, Nakhon Si Thammarat, Chumphon Provinces	Wave / Surge Tidal wave	200 US$267	homeless ,000 damage
4-Dec-99 7-Dec-99	Yala, Pattani, Narathiwat, Songkhla, Chumphon Provinces	Flood	2 2,000	killed affected
Jan-99 1999		Drought		
Jan-00	Northern, Northeastern regions	Epidemic Leptosporosis	89 1,946	Killed affected

Dates: Start, End date	Location:	Disaster: Type, Subtype, name	Numbers:	
16-Feb-00	Kalasin (Nakhon Panom Province)	Transport Accident Road	23 37	killed injured
25-Feb-00	Kanchanaburi Province	Transport Accident Air Military helicopter	11	killed
27-Feb-00	Near Bangkok	Transport Accident Road	12 30	killed injured
6-Mar-00	Map Ta Phut, Rayong	Industrial Accident Ind:Gas leak	1 194	killed injured
24-Mar-00	Nord-Est	Transport Accident Road	38	Killed
21-Jun-00	Muang, Mae Chan districts	Flood	2,500	affected
Jul-00	Phan, Mae Lao, Muang, Khuntan districts + Loei, Udon Thani, Nakhon Phnom, Sakhon Nakhon, Kalasin, Maha Sarakham, Roi-et, Surin, Buri Ram, Si Sa Ket, Yasathorn, Amnat Charoen, Ubon Ratchathani regions	Flood	47 2,500,000 US$51,050	killed affected ,000 damage
21-Aug-00	Tha Tum, Chom Phra, Samrong Thap, Sikhoraphum, Sangkha, Muang, Ubon Ratchathani (northeastern provinces)	Wind Storm Typhoon Kaemi	2 41,219	Killed affected
29-Aug-00	Bang Nam Priew district	Misc Accident Misc:Fire	800 US$3,517	homeless ,000 damage
21-Nov-00	Songkhla , Nakhon Si Thammarat, Surat Thani, Satun, Phattalung, Chumphon, Narathiwat, Yala, Pattani, Trang provinces	Flood	51 570 808,231 US$57,500	killed injured affected ,000 damage
27-Nov-00	Lampang province	Transport Accident Road	21 15	killed injured
6-Mar-01	Petchabun	Transport Accident Road	16 27	Killed injured
11-Mar-01	Pathiu (Chumphon prov.), Muang, Bang Saphan, Bang Saphan Noi, Hua Hin, Kui Buri, Sam Roi Yot (Prachuap Khiri Khan prov.), Si Satchanalai (Sukhothai prov.), Laplaie (Uttaradit prov.), Khanom Pak Phanang, Chalerm Phrakiat (Nakhon Si Thamarat prov.)	Flood	2 6,000	killed affected
4-May-01	Wang Chin district	Flood	33 630 4,510	killed homeless affected
4-May-01 5-May-01	Phrae, Sukhotai, Lampang provinces	Flood	83 30 4,100	killed injured homeless
27-Jun-01	Muang, La-ngu, Tha Phae, Khuan Don districts	Wind Storm Storm	150	affected
27-Jun-01	Southern Ranong province	Flood	1,000	affected
4-Aug-01	South	Transport Accident Water	16	killed
8-Aug-01 6-Sep-01	Nam Kor village (Lom Sak District, Phetchabun Province, Eastern Udon, Chiang Mai, Chiang Ra, Lam Phun, Nong Khai, Phrae and Nan Provinces	Flood	104 109 450,000 US$24,500	killed injured affected ,000 damage
31-Aug-01	Ubon Ratchathani, Yasothon	Flood	4,000	affected
25-Oct-01	Pak Chong (Nakhon Ratchasima)	Misc Accident Misc:Explosion Army ammunition waherouse complex	17 90 5,000	killed injured affected
1-Nov-01	Panthong district (Chonburi province)	Industrial Accident Ind:Explosion Painting factory	11 26	killed injured

Dates: Start, End date	Location:	Disaster: Type, Subtype, name	Numbers:	
12-Jan-02	Muang, Chiang Saen, Mae Chan, Wiang Chai, Phan districts	Wind Storm Storm	25,000	affected
24-Jan-02	Bangkok	Transport Accident Road	12 37	killed injured
Feb-02 2002	Nakhon Sawan, Udon Thani, Khon Kaen, Satun, Phrae, Loei, Kalasin, Sukhothai, Nakhon Ratchasima provinces	Drought	5,000,000 US$2,300	affected ,000 damage
23-Apr-02	Sam Ngao, Phop Phra districts (Tak)	Wind Storm Storm	500 2,000	homeless affected
3-Sep-02	Ban Tha Sala (Mae Hong Son)	Slides Landslide	39 750,000	killed affected
29-Sep-02	Kalasin province	Flood	1,500	affected
Oct-02	Tak, Chiang Mai, Chiang Rai, Lumpoon, Sukhothai, Pitsanulok, Mae Hong Son, Uttaradit, Phetchaboon, Phichit, Nakhon Sawan, Kamphaeng Phet, Uai Thani, Sakon Nakhon, Khon Kaen, Chaiyapoom, Nongkhai, Kalasin, Nakhonpanom, Nong Bua Lampoo, Roi-et, Sri Saket, U-bonratchathani	Flood	154 62 3,289,358 US$35,827	killed injured affected ,000 damage
19-Dec-02	Mae Ai district (Chiang Mai province)	Transport Accident Road	13	Killed
11-Mar-03 27-May-03	Bangkok, Chonburi, Songkhla	Epidemic Respiratory Acute respiratory syndrome (SARS)	2 7	Killed affected
11-Apr-03	Muang, Wiang Chai, Phan, Doi Luang, Mae Suai districts	Wind Storm Storm	5,000	affected
15-Oct-03	Petchaburi, Ratchaburi, Kanchanaburi, Prachuab Khiri Khan	Flood	3 3,000 US$25,000	killed affected ,000 damage
11-Dec-03	Nakhon Si Thammarat, Songkhla, Surat Thani, Yala provinces	Flood Flash Flood	6 104,700 US$1,400	killed affected ,000 damage
15-Oct-03 24-Mar-04	Sukhotai, Kanchanaburi, Suphanburi, Uttaradit, Lopburi, Ayudhaya	Epidemic Respiratory Infuenza (H5N1)	7 4	killed affected
3-Oct-03 25-Oct-03	Phuket, Phang-Nga, Satun, Trang provinces	Flood		
1-Jan-04 25-Nov-05	Prachin Buri, Kamphaeng Phet, Nonthaburi, Phetchabun (Kanchanaburi province)	Epidemic Respiratory Avion Influenza H5N1	14 8	killed affected
23-Apr-04	Tungmahamek area (Bangkok)	Misc Accident Fire	3,500	homeless
18-May-04	Chon Buri, Bight of Bangkok	Transport Accident Water	200 24	injured killed
25-May-04	Ayutthaya province	Transport Accident Road	15 30	killed injured
20-May-04 23-May-04	Mae Ramat (Tat province)	Wind Storm Storm	13 50 5,000	killed homeless affected
4-Jun-04 21-Jun-04	Prae, Nakhon Sawan, Sukhothai, Pichit, Mae Hong Son, Tak, Nan, Payao, Phitsanuok, Loei provinces	Wind Storm Typhoon Chanthu (Gener/08W)	1 4,000	killed affected
6-Aug-04 30-Aug-04	Na Di, Prachantakham, Bu Fai (Prachin Buri), Phanom Dongrak, Prasart, Chom Phra, Thatoom, Muang (Yasothon, Surin), Muang (Nakhon Nayok, Ubon Ratchathani), Satuk, Kandong (Buri Ram), Phaya Meng Rai, Wiang Chai (Roi Et, Chiang Rai), Rasi Salai (Kalasin, Si Sa Ket)	Flood Flash Flood	9 500,000	killed affected

Dates: Start, End date	Location:	Disaster: Type, Subtype, name	Numbers:	
15-Sep-04	Chian Rai, Chiang Mai, Ubon Ratchathani provinces	Flood Flash Flood	2 2,000	killed affected
3-Oct-04	Ayuthayah	Industrial Accident Explosion Firework factory 'Boon-Leur'	14 2	killed injured
18-Oct-04	Baan Huay Nam Khiew (Krabi's Muang district)	Slides Mudflow	3 10 100	killed injured affected
10-Dec-04 18-Dec-04	Sukhirin (Narathiwat), Phra Phrom, Hua Sai, Pak Phanang and Ron Phiboon (Nakhon Si Thammarat), Muang and Kongra (Phattalung), Tharn Toh (Yala)	Flood	2 5,000 US$175,000	killed affected ,000 damage
26-Dec-04	Krabi, Phang Nga, Phuket, Ranong, Satun, Trang	Wave / Surge Tsunami	8,345 8,457 58,550 US$405,200	Killed injured affected ,000 damage
17-Jan-05	Bangkok	Transport Accident Rail		
25-Jan-05	Near Koh Samui Isl.	Transport Accident Water Sea Breeze	17	killed
Jan-05 Mar-05		Drought	US$420,000	,000 damage damage
5-Mar-05	Phuket	Transport Accident Water Boat 'Runj Roj'	10 65	killed injured
21-May-05	Lampang, Nan provinces	Wind Storm Storm	1,500 US$246	affected ,000 damage
Aug-05	Satun, Phatthalung, Pattani, Yala, Narathiwat, Phuket, Songkhla	Wild Fires Forest		
13-Aug-05 31-Aug-05	Chiang Mai, Mae Hong Son, Chang Rai, Phayao , Lampang, Nan, Lamphun, Nakhon Phanom, Tak provinces	Flood	21 40 119,270 US$121,000	Killed injured affected ,000 damage
26-Sep-05 30-Sep-05	Lampang, Chiang Mai, Chiang Rai, Phayao, Mae Hong Son , Phrae,Yasothon, Ubon Ratchathani	Wind Storm Tropical storm Damrey	10 2,000	killed affected
23-Nov-05	Songkhla, Trang, Satun, Nakhon Si Thammarat, Phatthalung, Samui, Chomphon, Narathiwat, Pattani, Yala, provinces	Flood Flash Flood	55 132,216	killed affected
10-Feb-06 18-Feb-06	Narathiwat, Nakhon Si Thammarat, Chumphon, Surat Thani provinces	Flood	2,000	affected
22-May-06 2-Jun-06	Nan, Phrae, Lamphang, Sukhotai, Uttaradit provinces	Flood Flash Flood	116 342,895 US$8,100	Killed affected ,000 damage
20-Aug-06 24-Aug-06	Nan, Chiang Rai, Phayao provinces	Flood	14 477,391 US$4,300	killed affected ,000 damage
27-Aug-06 25-Sep-06	Chiang Rai, Chiang mai, Mae Hong Son, Lamphun, Lampang, Phrae, Phayao, Uttaradit, Phetchabun, Phitsanulok, Sukhotai, Tak, Kamphaeng Phet, Nakhon Sawan, Uthai Thani, Phichit (North), Chai Nat, Sing Buri, Angthong, Phra Nakhon Si Ayuttaya, Lop Buri, Saraburi, Pathum Thani, Nonthaburi, Nakhon Nayok, Cha Vhen Sao, Prachin Buri (Central Plain), Chonburi, Chanthaburi (East), Chaiyaphum, Khon Kaen (Northeast), Surat Thani, Nakhon Si Thammarat, Phang Nga (South)	Flood Flash Flood	49 2,400,000 US$8,137	Killed affected ,000 damage

Dates: Start, End date	Location:	Disaster: Type, Subtype, name	Numbers:	
Sep-06	Uttaradit, Chaing Mai provinces	Flood	12,500	affected

Source: "EM-DAT: The OFDA/CRED International Disaster Database www.em-dat.net - Université Catholique de Louvain - Brussels - Belgium"

ANNEX C: LIST OF PERSONS/ORGANIZATIONS INTERVIEWED

Interview List—Thailand Study (August–October 2006)

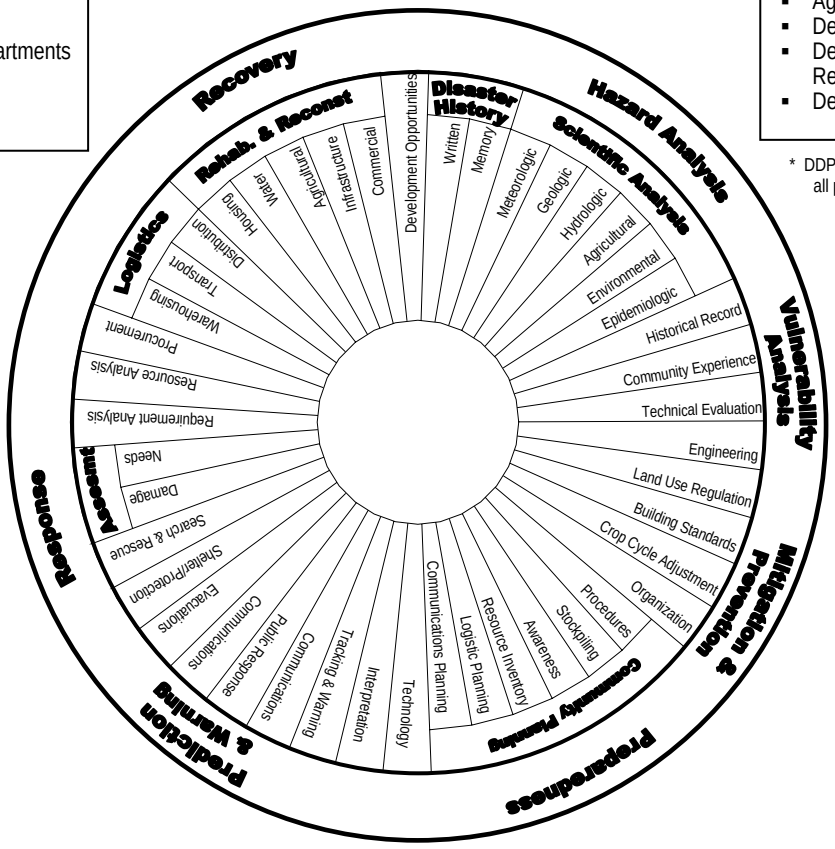
Organizations	Persons Met
Department of Drainage and Sewerage Bangkok Metropolitan Administration (BMA)	Director General - Teeradej Tangpraprutgul Civil Engineer, Operations Center - Mr. Sansung
Department of Geology, Faculty of Science Chulalongkorn University,	Dr. Kruawun Jankaew Dr. Montri Choowong Dr. Thasinee Charoentitirat
National Disaster Warning Center (NDWC)	Vice Executive Director - Rear Admiral Thaworn Charoendee Assistant Executive Director Operation - AVM. Pakdewat Vachirapanlop International Coordinator - Dr. Cherdsak Virapat
Department of Public Works and Town & Country Planning (DPT)	Architect - Mr. Chotechuang Srihirantiti
Department of Provincial Administration (DoPA), Ministry of Interior	Chief of Communication Unit – Sub-Lieutenant Narongchai Chindaphan
Geological Survey Bureau Department of Mineral Resources (DMR)	Director - Lertsin Raksaskulwong
Department of Marine and Coastal Resources (DMCR)	Acting Director - Ms.Cherchinda Chotiyaputta
Department of Disaster Prevention and Mitigation (DDPM)	Chief of Natural Disaster Policy - Mr. Montree Chanachaiviboonwat
Thai Red Cross Society	Director of Relief and Public Health Bureau - Lieutenant General Dr. Amnat Barlee Ms.Wantanee Kongsomboon
Hydrographic Department Royal Thai Navy	Director, Oceanographic Division - Captain Witoon Tantigun, Deputy Director - Captain Komsan Klinsukon,
Seismological Bureau, Thai Meteorological Department (TMD)	Director - Sumalee Prachuab
Worldwide Fund for Nature (WWF)	Partnership Coordinator, Greater Mekong Thailand Country Program - Ms Angie Woo
Thammasat University	Dr. Tavida Kamolvej
Asian Disaster Preparedness Center (ADPC)	Director, Climate Risk Management - Mr. Arjuna Perumal Subbiah

ANNEX D: SCHEMATIC OF GOVERNMENT STRUCTURE FOR DISASTER MANAGEMENT

RECOVERY
- DDPM
- Provincial Governors, District Chiefs
- Local Authorities – PAOs DAOs, TAOs
- NGOs & CBOs
- All line ministries and departments

HAZARD ANALYSIS
- DDPM*
- NDWC*
- Thai Meteorological Department
- Royal Irrigation Department
- Agriculture Department
- Department of Mineral Resources
- Department of Marine and Coastal Resources
- Department of Health

* DDPM, NDWC, other agencies may be involved in all phases of disaster management cycle



RESPONSE
- Ministry of Interior
- DDPM
- Provincial Governors, District Chiefs
- Local Authorities –PAOs DAOs, TAOs
- Police
- Armed Forces
- NGOs & CBOs
- All other line departments

VULNERABILITY ANALYSIS
- DDPM
- NDWC
- Ministry of Human Security and Social Development
- Ministry of Policy Planning
- Department of Health
- Department of Survey
- Department of Public Works & Town Planning

PREDICTION & EARLY WARNING
- NDWC
- Department of Mineral Resources
- Royal Irrigation Department
- Thai Meteorological Department
- Royal Thai Navy
- Police
- TV, Radio, Press

MITIGATION
- DDPM
- Ministry of Policy Planning
- Department of Public Works & Town Planning
- Department of Agriculture, Agricultural Research Stations
- Royal Irrigation Department
- Provincial Governors, District Chiefs; Local Authorities - PAOs DAOs, TAOs
- All Line departments
- NGOs & CBOs

PREPAREDNESS
- DDPM
- DMR ; All other line departments
- Provincial Governors, District Chiefs
- Local Authorities - PAOs DAOs, TAOs

TRAINING & AWARENESS
- DDPM
- Department of Education, Universities;
- NGOs & CBOs
- NDWC
- DMR

ANNEX E: INFORMATION SOURCES

Assessments	
1. Assessment of Capacity Building Requirements for an Effective and Durable Tsunami Warning and Mitigation System in the Indian Ocean http://ioc3.unesco.org/indotsunami/nationalassessments.htm	Contains summary of presentations made by the IOC Assessment Mission members and the national experts; proposals submitted to IOC; recommendations; and general observations and conclusions related to EWS in Thailand. The IOC questionnaire has also been filled in.
Studies and Relevant Background	
2. National Disaster Warning Center (NWDC) Policy	Published by the Prime Minister's Office, Order No. 16/2548
3. National Safety Council of Thailand	Published by the Prime Minister's Office, Bangkok, 1999
4. Civil Defence Act 1979	Published by Royal Gazette Book 1979
5. NDWC-PDC Information and Communication Technology (ICT) GAP Analysis Report	Published by the Pacific Disaster Center (PDC) 2006
6. Concept of Operations (CONOPS) of NDWC	Develop together with the IOC, PDC, and JMA for the information flow for warning dissemination, 2005
7. Planning a Nation Disaster Early Warning System in Thailand	
8. International Disaster Response Laws, Rules and Principles (IDRL) Programme Case Study, published by IFRC 2006	Legal issues arising from the international response to the tsunami in Thailand
9. Thailand Country paper for World Conference on Disaster Reduction (WCDR) 2005	Published in the WCDR Report 2006
10. Tsunami Risk Mitigation Strategy for Thailand	Published by Norwegian Geotechnical Institute February 2006
11. Tsunami Thailand: One Year Later, National Response and Contribution of International Partners	Published by United Nations for Thailand's effective response to the tsunami and challenges that remain in ensuring a sustainable and equitable recovery
Data Sources: Disasters, Demography and others	
12. Natural Disaster Profiles for Indian Ocean Countries: Indonesia; Center for Hazards and Risk Research, Columbia University http://www.ldeo.columbia.edu/chrr/research/profiles/pdfs/thailand_profile1.pdf	Profiles provide information on sub-national areas at risk from natural hazards including cyclones, droughts, earthquakes, volcanoes, floods, and landslides. In addition to basic geographic and socio-economic facts, the profiles include maps