3. Cambodia

3.1 Background

The Kingdom of Cambodia, or Kampuchea as it was earlier called, is located in Southeast Asia between latitudes 10° and 15° north and longitudes 102° and 108° east. It covers an area of 181,035 sq. km., bordered by Thailand and Lao PDR to the north, Vietnam to its east and the Gulf of Thailand to the southwest. Once the center of the famous Khmer Empire, today Cambodia is still recovering from the aftermath of years of war and strife. The topography is mostly flat, but there are mountainous areas in the southwest, northern border with Thailand, and the northeast. About three-fourths of the country is covered by tropical forest and only one-fifth is arable land. The bulk of the remaining land is composed of sandy and infertile soil.

The Mekong River and the Tonle Sap (Great Lake) are the major water sources. The climate is governed by two monsoons; the cool, dry northeastern monsoon from November to March and the humid southwestern monsoon from May to October. Average annual temperatures vary from 21°C to 35°C.

Natural hazards and disasters

In the past decade about 11.45% of the population was affected by natural disasters (CRED, IFRC, 2001[10]). The major disasters experienced by Cambodia are floods, droughts, forest fires, landslides and storms. Besides the natural hazards, Cambodia also suffers from man-made disasters like armed conflict that have resulted in problems of refugees, displaced population and landmines.

According to a study by the Department of Meteorology, Cambodia, seasonal events such as the 1998 El Niño phenomenon extended the dry season and increased the average temperature by 2.5° Celsius. On the other hand, the La Niña phenomenon increased the average annual precipitation in the years1996 and 2000 and raised the water levels.

Floods and windstorms

The Mekong River enters into a very low part of the Mekong River Delta and becomes a slow-flowing braided river. When flooding occurs, it often covers large areas of the country. Each year, up to four million hectares of lowland areas are inundated. Water-regulating structures have been built on some tributaries, allowing farmers to control inflow from rising floodwaters to the lowland areas for a short period of time. The recent floods of the year 2000 were severe, affecting about 84 districts and 595 communes with an estimated damage of US$145 million (NCDM, 2002). The recent drought of the year 2001, left 530,844 people with inadequate access to basic food and about 53,987 hectares of rice fields were damaged.

[10] Source: World Disaster Report, 2001

Cambodia is not as prone to typhoons as its neighbour, Vietnam. By the time the typhoon reaches Cambodia after crossing Vietnam, its intensity weakens and the wind is no longer threatening. However, even a low intensity typhoon brings rain that might cause flooding. Typhoon Linda, which crossed Cambodia in 1998 affected the southern coastal areas in which the island of Pou Lo Wei was most affected, reporting a wreckage of 81 fishing boats and hundreds of victims.

3.2 Hazard Detection

3.2.1 Weather Forecast

Weather forecasts and typhoon detection and warning are the responsibility of the Department of Meteorology (DoM). The Meteorological Center at the DoM issues 24-hour weather forecasts based on the data received from 14 synoptic stations, the weather condition transmitted from the Japanese weather satellite, and information such as the results of numerical weather prediction coming from the Regional Specialized Meteorological Center (RSMC) in Tokyo. The data from the various stations in Cambodia is received through radio transreceiver and telephone. The DoM at present has no capabilities to issue long-range forecasts.

MoWRAM undertakes studies on monthly average and minimum temperatures to monitor ENSO impact over the country. Weather prediction is undertaken considering the meteorological data from provinces and synoptic maps through Internet (displayed by Thailand). Weekly prediction is based upon the data available on the Internet while seasonal predictions are based on the Southern Oscillation Index (SOI), especially the model of average annual temperature.

DoM is one of the members of the Typhoon committee. The forecasts and typhoon warnings are transmitted to the following disseminators and end-users of the forecast:

a) Ministry of Water Resources and Meteorology (MoWRAM)
b) National Committee for Disaster Management (NCDM)
c) Tri-media (television, radio and newspaper)
d) Prime Minister's Cabinet
e) The King's Cabinet
f) Special users that include farmers, fishermen, businesses and media

The Typhoon Committee approves the format and content of the information within the forecast and warnings. The terminologies are used in accordance with the standard terminologies agreed upon by the Typhoon Committee.

3.2.2 Flood Forecasting and Prediction

Flood forecasting is the most important activity carried out in the wet season by the Department of Hydrology and River Works (DHRW) of the Ministry of Water Resources and Meteorology (MoWRAM). The Hydrology Department is also responsible for the regular maintenance of gauging stations, maintenance of the database and flood prediction. The relevant data is received from 10 hydrological stations (along the Mekong main stream, Bassac and Tonle Sap River) and from the DoM to predict up to 3 days of water level in the Mekong River.

Data from the hydrological stations is transmitted daily to the central hydrological department (DoH) from September to November at 0700 hrs by single side band radio or a messenger on motorbike. The same set of data is transmitted to the MRCS in Phnom Penh through facsimile. The data collected by MRCS from the 4 countries is used for forecasting the water level at various stations and the results are disseminated through facsimile or Internet. For Cambodia, the MRCS sends the water level forecast to the DHRW. Below is a sample of flood warning information that is available at the MRCS website (Figure 3.1).

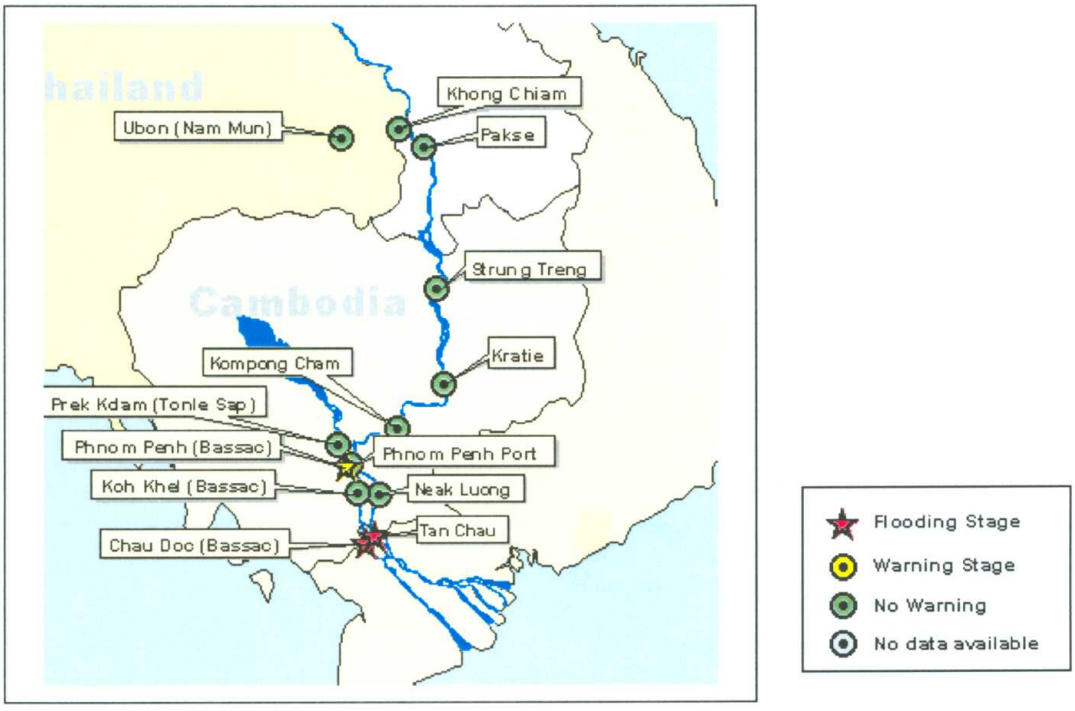

Figure 3.1. Flood information on 1 October 2001 from the MRC website

DHRW also prepares its own three-day flood (water level) prediction based on local experience and local models. The Regression and Auto Regression Analysis and the Sogreah Model Analysis are currently used by the DHRW for flood prediction.

Present capacities in flood forecasts

The DHRW has five offices (one of which is dedicated to Flood Forecasting and Water Quality Analysis, FF&WQA) and 15 Provincial Hydrometeorological Offices. The FF&WQA is staffed with engineers and technicians responsible for the regular maintenance of observing stations and preparation of flood predictions. Regular staff man the most important hydrological stations. Part-time observers man the other hydrological stations.

The DHRW maintains six main observing stations; of which only three stations have data loggers. Observers who report to the central forecasting office by radio or through a messenger staff all the stations. The DHRW also operates the 72 newly established or rehabilitated rain stations, ten of which have data loggers. Sixty-two stations located on

the main tributaries are equipped with staff gauges to measure water levels. Some of these stations are also located with rain stations. Data from these stations are collected during regular inspections and used as input to run a computer model tried and tested to approximate the observed levels.

3.3 Hazard Warning

Flood warning

There are two levels of flood bulletins issued to the public:

a) Flood Advisory: A flood advisory contains recommended actions to be taken by the public. It informs the public of an imminent flood situation. The advisory is issued when the hydrological condition deteriorates or when the condition improves but the public is still advised to be cautious.

b) Flood Warning: It is issued when flooding is predicted to occur within 24 hours. The warning is maintained as long as the affected areas are inundated and the attendant dangers are present.

3.4 Warning Dissemination

The DHRW warning system capitalizes on the existing disaster management system in Cambodia to relay the warning to the affected village level. The disaster management system was established in 1994 with the creation of the National Committee for Disaster Management (NCDM) through a sub-decree (No. 35 ANKR-BK, dated 27 March 1994) signed by the Prime Minister and later amended (No. 54 ANKR-BK, dated 14 June 1999). One of the functions of NCDM, through its Department of Emergency Preparedness and Training is to issue bulletins to provide information on all forms of disasters and to coordinate with related institutions to get information and data on disaster predictions. The NCDM transmits the information on the flood situation, flood advisory and flood warning through the sub-national committees on disaster management down to the village level.

Figure 3.2 illustrates the flood warning dissemination scheme in Cambodia. From the central to the local level, warnings are disseminated through facsimile, telephone and through a messenger. Though some district offices use hand-held radios, they are expensive to maintain and most often are not functioning due to shortage of battery supply.

At the village level, the Village Chief is responsible for disseminating warning. The Chief gathers the heads of families (mainly males) to provide information on the flood situation obtained from the Commune Chief, who in turn gets the information from the District Leader. In some villages, a Village Development Committee (VDC), which is usually organized by NGOs, assists the community on development work. This VDC is not organic to the village structure and thus its presence is not reflected in the warning dissemination scheme. However, VDC provides another channel for effective dissemination of warning to the public.

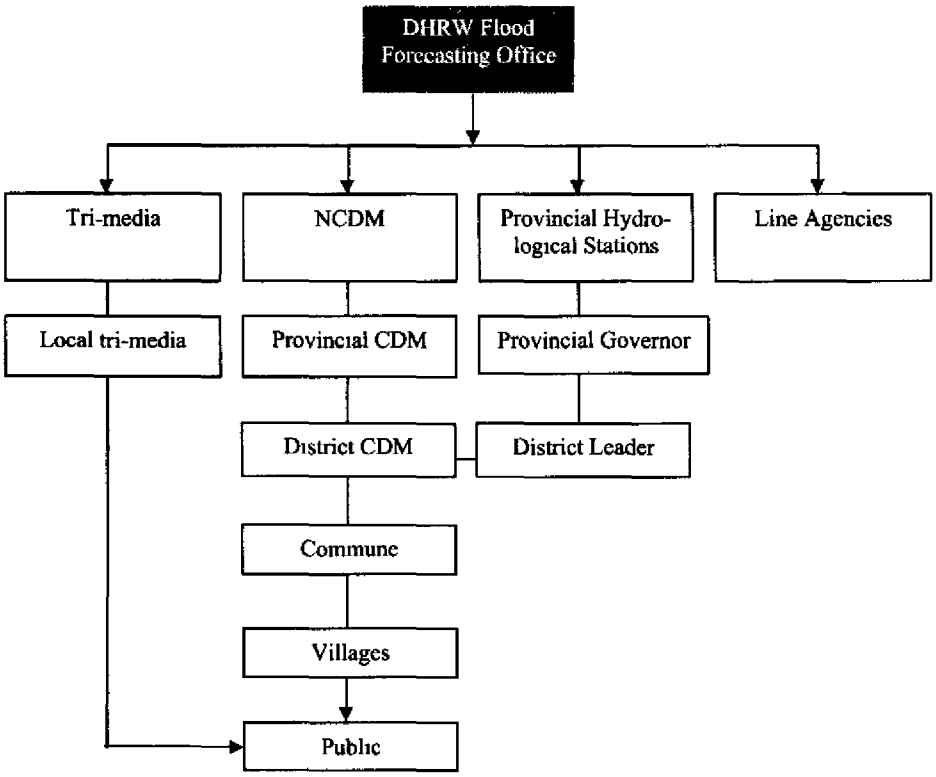

Figure 3.2. Dissemination scheme for flood warning in Cambodia

3.5 Community Response

Habitation in rural Cambodia has traditionally been designed in response to the predominant hazards. Thus, traditional Khmer houses are raised high on stilts to avoid flooding, to provide space for the family's livestock, and to make the houses cool in the hot and dry season. The roofs are either thatch or galvanized iron sheets. Some families have also adapted to living in boat-houses (Figure 3.3).

Most families, who are farmers, depend on rainfall for rice production and vegetable crops for their subsistence. Through the villagers' experience of annual flooding and prolonged dry spell (drought), they have initiated local solutions in their capacity to minimize the impact of floods. For instance, the farmers know when to plant and harvest rice and other crops. In their natural farming and living environment, there are raised areas that were purposely built as refuge areas for animals and people alike. In Boeng Daol Village in Prea Sdach District, six safe areas have been plotted in the village map. These are a pagoda, four hills where families reside and one hill that does not have permanent residents.