

# CONCLUDING REPORT

## **ACTION PLAN TOWARD EFFECTIVE FLOOD HAZARD MAPPING IN KOPONG SPEU CITY CAMBODIA**

The Region-focused Training Course on Flood Hazard  
Mapping

JFY2006

LONG SARAVUTH/Hydrologist  
Department of Hydrology and River works  
Ministry of Water resources and Meteorology  
*#576 National Road N2 Sangkat Chak Angre Kram Phnom Penh, CAMBODIA*

Email: [lsaravuth@online.com.kh](mailto:lsaravuth@online.com.kh), [dhrw.cambodia@online.com.kh](mailto:dhrw.cambodia@online.com.kh).

## **A)THE ROLE OF FLOOD HAZARD MAPS TO MITIGATE FLOOD MANAGES IN CAMBODIA**

### **A-1-The flood Status in Cambodia**

Cambodia is one of the fourteen countries in Asia considered to be the most prone to natural disasters. Natural disasters to which the country is subjected include floods (the most serious), drought and tropical storms. Man-made disasters include fire, transmitted diseases, and landmines that lie buried along Cambodian-Thai border.

The flooding that occurs every year throughout the basin of the Mekong River in Cambodia as a result of seasonal rains is the only one phenomenon that makes the country one of the most disaster-prone areas. Such flooding has caused the loss of lives, properties, destruction of public infra- structures and hindered the agricultural production. Cambodia's vast flood plain is one of the country's most prominent geographical features, making large portions of the country prone to flooding by the Mekong River and from the heavy rainfalls. The majority of the Cambodian people living in these low-lying areas depend upon subsistence farming for their livelihoods. Thus, the yearly occurrence of floods and other disasters results in grave consequences in terms of impacts on social, economic, productive aspects for rural population throughout the country and infrastructure in provinces along Mekong River and around Tonle Sap Great Lake. The Royal Government of Cambodia expresses deep concerns about the climate change, and especially the Mekong flood as it reaches extremely high water level.

In 1991, some parts of the countries experience a serious drought and flood causing widespread crop failures in some areas. Both problems-drought and flood-are likely to become worse as a consequence of the rapid deforestation in large areas of the country.

The flooding of 2000 reportedly the worst in more than 70 years (1961, 1966,1978, 1984, 1991 and 1996) put the death toll at 347, which 80% were children. More than 3,000,000 of people were affected and nearly 400,000 individuals had to be temporarily evacuated. Furthermore, more than 300,000 houses were damaged and 7,000 were destroyed. Hundred of school buildings, health centers and other infrastructures were also seriously damaged. The total damage costs was estimated at US\$ 157 million.

Consecutively, in 2001 and 2002, Cambodia was again affected by Mekong flood and drought. The same affected areas continue to get the impacts on social, economic, cultural and educational aspect, and infrastructure, but not so serious like the big flood in 2000 due to the better implementation of disaster planning to minimize the damages and ensure a safe community free from threat of flood.

- Death toll: 347
- Houses affected: 317,400 houses (destroyed 7,000)
- Education - Schools: 988 damaged in 13 provinces
- Health - Health centers damaged 138
- Production -Rice crop destroyed: 374,000 ha, Other crops destroyed: 47,000 ha, Livestock lost: 3900heads
- Infrastructure -National & provincial road damaged: 2,600 km, Secondary road, damaged: 1,500 km , Rail road damaged: 34 km , Bridges: 115 sites damaged, Wells, culverts: 11,900 damaged, Irrigation systems damaged: 123 sites

## Comparison of Flood Impacts on Population

Year	Impacts		
	Household	People	Death toll
1996	386,132	2,029,748	169
2000	750,618	448,629	347
2001	429,689	2,121,952	62
2002	296,234	1,439,936	29

### **A-2-The Outline of the present counter measures for mitigating flood damages in Cambodia**

The MOWRAM has the right to prohibit activities that are likely to damage flood protection works or to obstruct the natural flow of rivers. Structural (curative) as well as non-structural (preventive) measures have been proposed to alleviate the flooding problem.

#### **Structural Measures**

- Flood Control Dams

Some examples of dams specially constructed for flood mitigation are Kob Srov Dam and Tamok Dam built by MOWRAM for water supply, Irrigation but also serves as a flood mitigation dam.

- River Works

River works, which are carried out by Office River Works are realignment and canalization of river channels, including widening and deepening to improve original undersized channels.

#### **Non-structural Measures**

Non-structural measures are employed more for preventing floods from occurring and with the aim of minimizing losses due to flooding. Some of these measures are:

- River Basin Management

Under the concept of River Basin Management, the whole river basin is planned in an integrated manner and all factors are taken into consideration when a certain development plan is proposed. Factors like zoning for river corridors, riparian areas, natural flood plain, conservation of wetlands, storage ponds etc will be taken into consideration when preparing flood management plans.

- Flood Forecasting and Warning System

Telemetric forecasting systems have been installed in the major river basins namely Stung Treng, Kratie, Prek Kdam and Kompong Loung flood forecasting systems and flood marks have been established in smaller basins.

Department Hydrology and River Works also provides a bulletin and web-site information system on flood warning and flood response will be functional after the flood

event occurs especially during the monsoon season. It's included with the five main activities as below:

- 'Pre' flood, 'During' flood and 'Post' flood
  - Flood forecasting and warning system
  - Flood disaster management, flood fighting, evacuation
  - Flood operation and relief centers at District, State and Federal levels
  - Flood damage assessment
- First Warning is made to the Public by Minister / Secretary of State (MOWRAM) when both observed and forecasted levels exceed the Warning Levels.
  - Second Warning is made to the Public by Minister/Secretary of State (MOWRAM) when both observed and forecasted levels rise closely to the Flooding Levels.
  - Flood Alarming is made to the Public by Minister/Secretary of State (MOWRAM) when both observed and forecasted levels exceed the Flooding Levels.



**Picture of Flood Information Board.**



**Picture of Flood Marks**

**A-3-Do you think flood hazard maps will be useful in Cambodia**

Flood Hazard Map is very useful to be implemented in Cambodia. With regards of the Flood Hazard Map objectives, to prevent loss of people's lives and helps smooth refugee from home to evacuation shelter as well as to notifying the residents of potential flood damage and enhancing their awareness of the importance of flood disaster preparedness could be achieved.

**B)THE ALLOCATION OF ROLE IN MAKING FLOOD HAZARD MAPS IN CAMBODIA**

**B-1-Organization should hold the main responsibility for making a fundamental map such as anticipate inundation area map.**

No	Agency	Role
1	Ministry of Water Resources and Meteorology	-Planning, coordinating and supervising relief -Operations during flood. Support the flood disaster preparedness activities among the committee members. - Providing flood forecasting and warning service to the public. - Main organizations for planning, prepare and disseminate Flood Hazard Map. -Providing weather forecast information due to flood forecasting and warning activities
2	Ministry of Finance	-Prepare budgets for five yearly developments.
3	Ministry of Environment	-Support and provide development allocation for flood mitigation projects at the federal level.
4	Ministry of Land	-Providing the digital topographic map, DEM of the drainage basin
5	Provincial Government	-Support and provide development allocation for flood mitigation projects at the state level. - Dissemination of Flood Hazard Map - Provide information on evacuation routes in their region.

**B-2-Organization should hold the main responsibility for making and disseminating flood hazard maps.**

No	Agency	Role
1	Ministry of Water Resources and Meteorology	-Making Flood Hazard Map. -Dissemination of Flood Hazard Map
2	Ministry of Finance	-Prepare budgets
3	Ministry of Environment	-Support
4	Ministry of Land	-Providing the digital topographic map, DEM of the drainage basin
5	Provincial Government	- Dissemination of Flood Hazard Map
6	National Committee for Disaster Management.	- Dissemination of Flood Hazard Map
7	Cambodia Red Cross	- Dissemination of Flood Hazard Map

## C)THE ACTION PLAN OF MAKING FLOOD HAZARD MAPS IN CAMBODIA

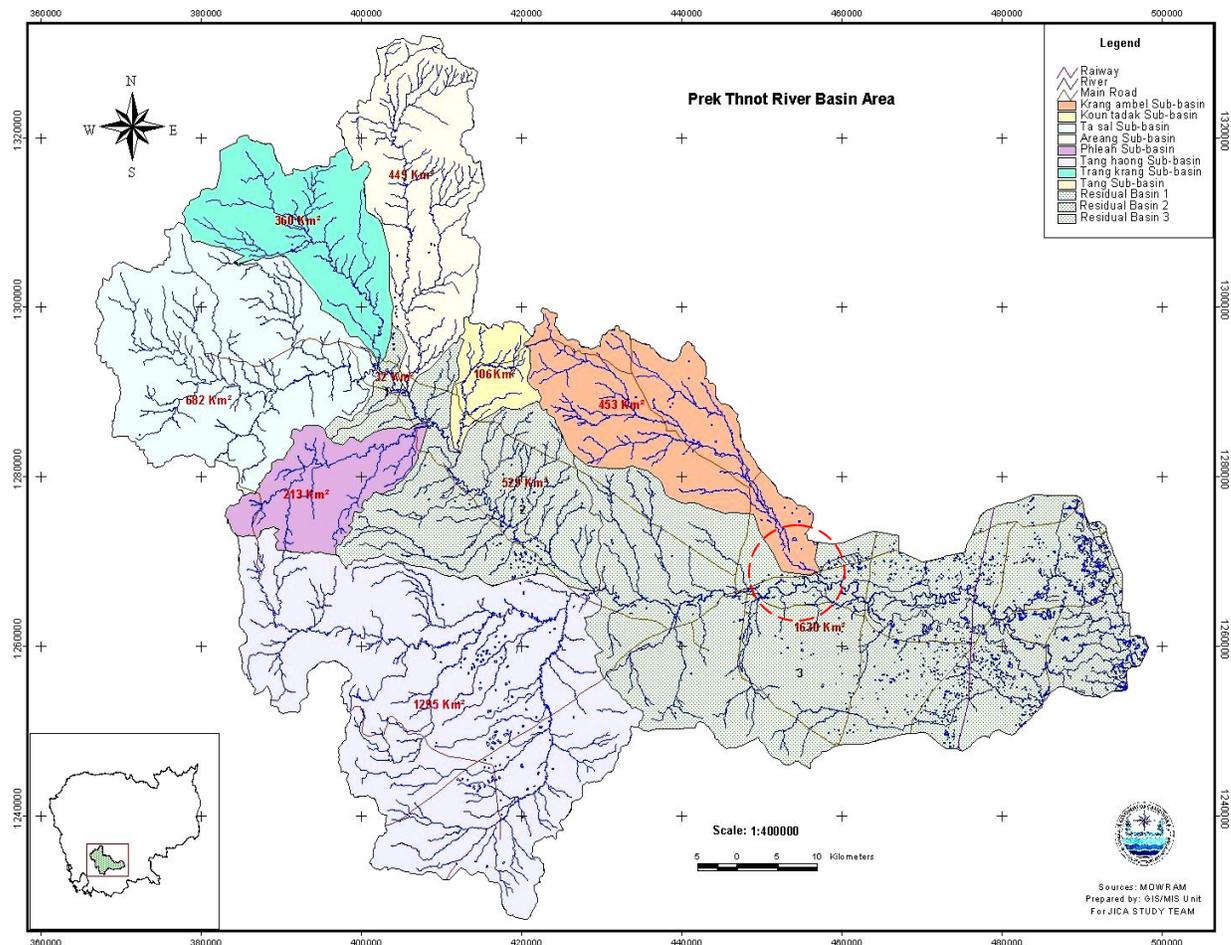
### C-1-Stung Prek Thnot River Basin are the target area for flood hazard maps

The Prek Thnot River flows in the direction of southeast to east from the Elephant mountain region as origin. The highest elevation of the basin is El. 1,543 m above mean sea level. The schematic diagram of the Prek Thnot River system is shown in Figure 1. The Prek Thnot River joins the Bassac River at Kandal. The catchments area of the Prek Thnot River and the length of river course are about 5,740 km<sup>2</sup> and 232 km at the confluence with the Bassac River.

The major tributaries and the catchments area of the tributaries are as shown here.

**Catchment Area of Sub-basin**

Sub-basin	Catchment Area (km <sup>2</sup> )
101 Ta Sal River	682
102 Trang Krang River	360
103 Areang River	445
104 Phleach River	213
105 Koun Tadak River	106
106 Tang Haong River	1,295
<b>107 Krang Ambel River</b>	<b>453</b>
Residual Basin	2,186
Total	5,740



**Figure 1 Target area Krang Ambel Village**

**C-2-Necessary Stung Prek Thnot River Basin are the target area for flood hazard maps**

FHM is necessary to prevent loss of people's lives and helps smooth refugee from home to evacuation shelter as well as to notifying the residents of potential flood damage and enhancing their awareness of the importance of flood disaster preparedness

**Statistic table along Stung Prek Thnot River Basin**

Province	Kampong Speu	Kandal	Takeo	Total
District	Aoral, Chbar Mon Kong Pesi, Phnom Chrouch Samrong Tong	Kandal Steung Ang Snoul	Bati	8
Number of Commune	43	32	4	79
Population	329,309	145,525	30,942	505,776
Household	63,576	29,419	6,152	99,147
Rice field	55,143	19,048	7,130	81,321

**New Rainfall Gauging Stations**

No.	Station Name	Equipment	District/Village	Location (UTM)	
				Northing	Easting
1	Kirirom	Automatic	Phnom Sruoch	1252931	396882
2	Wat Kdey Lvea	Automatic	Samrongtong	1268598	462114
3	Kong Pisey	Automatic	Kong Pisey	1247922	459627
4	Trapeang Chour	Automatic	Aoral	1306348	405995
5	Thpong	Automatic	Thpong	1299115	438559
6	Peam Khley	Automatic	Phnom Sruoch	1267566	430740
7	Phum Chum	Automatic	Aoral	1294020	383194
8	Roleang Chrey	Automatic	Samrongtong	1264829	439962
9	Prey Kaniech	Automatic	Phnom Sruoch	1262000	409200
10	O Kon Trom	Automatic	Phnom Sruoch	1238125	417515

**New Water Level Gauging Stations**

No.	Station Name	Equipment	District/Village	Location (UTM)	
				Northing	Easting
1	Peam Khley Bridge	Logger & S.G.	Phnom Sruoch	1266500	430871
2	Thnuos Luong	Logger & S.G.	Chbr Mon	1266357	446561
3	Krang Chek	Logger & S.G.	Phnom Sruoch	1261082	402458
4	Cheneang Kpuos	Logger & S.G.	Phnom Sruoch	1265906	427244
5	Sangkea Tasal	Logger & S.G.	Aoral	1290500	405000
6	Trapeang Kchon	Logger & S.G.	Samrongtong	1267436	458215
7	Roleang Chrey	S.G.	Samrongtong	1265095	440236
8	Prey Mean	S.G.	Aoral	1285872	406818

### C-3-Five years Action Plan for flood hazard maps Stung Prek Thnot River Basin

Floodplain Management Plan study for one of the proposed area will possibly be carried out, Flood Hazard Map for any of the area will at the same time be made. Opportunities to effectively put in and come up with Flood Hazard Map in the study will be a good ground for testing knowledge and experiences gain in this course. It is also necessary to foresee on how flood hazard map can be developed for other river floodplain. Summary of general action plan within 5 years ahead as follow:

Year	Action Plan
2007	<ul style="list-style-type: none"> <li>- Deliver a presentation of FHM to my department</li> <li>- Formed the committee members of FHM</li> <li>- Gain and enhance my knowledge in anticipated inundation area mapping, Topographic Map and GIS (Flood Runoff Analysis)</li> <li>- Check the viability and update topographic map at Department of Survey Mapping and Data collecting</li> <li>- Having some meeting and understanding of FHM between the related organizations</li> <li>- Get an opinion and idea from the local residents' perspective of FHM</li> </ul>
2008	<ul style="list-style-type: none"> <li>- Promote the idea of FHM to the local government.</li> <li>- Educating people and enhancing their awareness due to flood disaster preparedness</li> <li>- Start planning and doing some ground works of FHM for rural area. Target area</li> </ul>
2009	<ul style="list-style-type: none"> <li>- Carry out survey to study effectiveness –DHRW</li> <li>- Model construction (consists Topographic Modeling, Flood Modeling and Flood Stimulation).</li> </ul>
2010	<ul style="list-style-type: none"> <li>- Model construction (consists Topographic Modeling, Flood Modeling and Flood Stimulation)(cont ...)</li> </ul>
2011	<ul style="list-style-type: none"> <li>- To disseminate the completed FHM to the target group (State Resident)</li> <li>- Educating people and enhancing their awareness due to flood disaster preparedness</li> <li>- Carry out survey to study effectiveness Stung Prek Thnot River Basin</li> <li>- To conduct survey via questionnaire to the target groups with the view to improve the usefulness of the FHM</li> </ul>

## **C-4-Problem**

Problems that might be faced in the process of developing Flood Hazard Map in Stung Prek Thnot can be divided into aspects as follow:

- **Insufficient data (hydrological and topographic)**

It is recognized that numerical simulation at best possible is one of the most important part of flood hazard mapping. In Stung Prek Thnot, installation of gauging station to capture hydrological information have year ago covered most part of the state and lack of data is anticipated to be one of the constraint. Topographic data of flooded area will be another constraint in coming up with anticipated inundation area for particular area. Alternatively, any kind of possible statistic method in acquiring hydrological data for un-gauge river basin as well as any available topographic information will be utilized as best as it can.

- **Community awareness level**

In view of the impact of introducing flood hazard map as non-structural measure in reducing and preventing lost of human life, it is expected that certain level of community will have different perception of the map. There might be group of community looking it as threat rather than information for preparedness and any other perception related to properties value or so. Effective awareness rising and community consultation in the initial stage of the map development will be helpful to overcome this problem. Working with community based non-government organization to carry out this is also a possibility.

### **Suggestions for making this training course more meaningful**

Exercise session such as the rainfall-runoff analysis should be given more time as it is one of the important technical knowledge necessary for production of inundation area map. Especially software for analysis should be given more time for practice.

The participants that have done something or manage to come up with flood hazard mapping in his/her country if possible invited to give lecture and share his experiences on how he gone through the actual process in the next course.

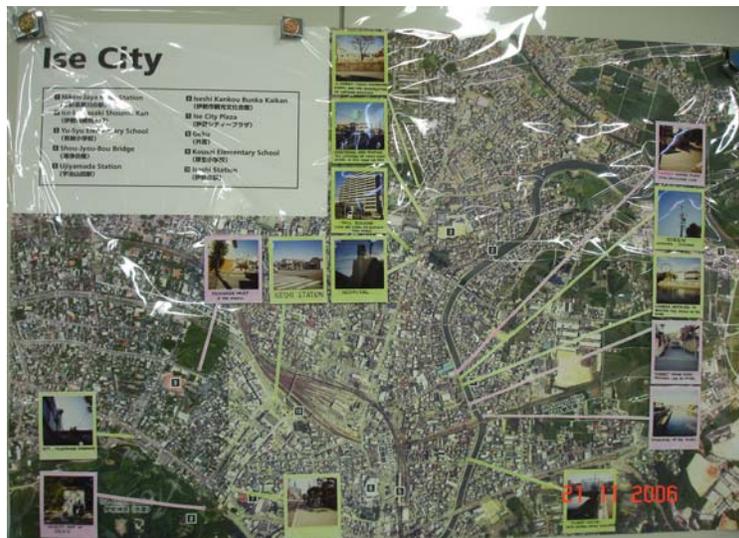
### **Concluding remark**

As mentioned earlier, Flood Hazard Mapping will be definitely beneficial to the management and reductions of damages caused by flood in Cambodia generally and Stung Prek Thnot particularly. Since flood hazard mapping has not yet being carried out in any part of Stung Prek Thnot, this training course has provide the opportunities for government of Cambodia to enhance its flood hazard map and for Stung Prek Thnot to start in certain level to produce flood hazard map. Consideration, support and willingness of Japanese Government Agencies especially Japan International Cooperation Agency (JICA), Public Works Research Institute (PWRI) and all the participating country in relation to the training course are highly appreciated.

## D)THE FLOOD HAZARD MAP ON ISE CITY



**HAZARD MAP ON ISE CITY**



### **BAD POINT AND GOOD POINT**

#### **C-4-The improvement from the FHM on Ise city.**

The improvement from the FHM on Ise city are :

- -Improve the professional knowledge of hydrology, hydraulics and river engineering necessary to produce flood hazard maps,
- -Improve the effectiveness of flood hazard maps and how to disseminate and utilize them for people,
- -Improve the methods to enhance people's capability and promote public awareness to mitigate flood damage,
- -Improve an understanding of the way to produce and apply flood hazard maps