Concluding Report for
JICA Region-Focused Training Course on Flood Hazard Mapping
JFY 2005

Title

Roadmap Towards Effective Flood Hazard Mapping in Malaysia

November 2005

Prepared by

Miklin Ationg
Engineer
Water Resources Management Section
Department of Irrigation and Drainage
State of Sabah, Malaysia

1. Introduction

The regional-focused training course on Flood Hazard Mapping was conducted on 7 November until 2 December 2005 by Public Works Research Institute (PWRI) of Ministry of Land, Infrastructure and Transport, Japan together with the Japan International Cooperation Agency (JICA). A total of 16 participants from 8 countries (Cambodia, China, Indonesia, Lao PDR, Malaysia, Philippines, Thailand and Vietnam) attended the course.

During the course, lectures related to flood were given not only by experts throughout Japan but also from other countries, China and Mekong River Commission. In those lectures, topics related to flood hazard map were discussed comprising history and principal of flood hazard mapping in Japan, numerical simulation to obtain anticipated inundation area, evacuations procedures as well as experiences in producing flood hazard maps throughout Japan. Beside lectures, 3 days of special field work on 'Town Watching' was conducted in Mie Prefecture covering Tsu City, Ise City , Miya River and Shonai River with participation from various offices and community group within the area.

2. Role of Flood Hazard Map to mitigate flood damages in Sabah, Malaysia

This chapter basically will discuss on the flood status in Malaysia, the present countermeasures for mitigating damages caused by flood and the importance of flood hazard map in the context of existing policy throughout Malaysia.

2.1 The flood status in Malaysia

Flooding is a regular occurrence in Sabah and affects virtually very district and municipality to some extent. The severity of flooding varies from year to year, and also from river basin to river basin. Low lying area, floodplains and developed river basin throughout Malaysia experienced flood to a various extent of seriousness in terms of depth, inundated area, duration and damages. Floods in urban areas, particularly where there is little or no warning, have the potential to cause for more damage than main stream flooding where warning times are greater. Even the overflow of local street drainage, which may do no more than disrupt traffic for an hour or so, has a cost penalty attached. Summary of flood condition in Malaysia as at year 2000 is as in Table 1.

Table 1: Summary of Flood Condition in Malaysia

	Peninsular Malaysia	Sabah	Sarawak	**Malaysia**
Total Area (km^2)	**131,574**	**73,712**	**124,449**	329,735
Flood Affected Area ($km^{2)}$	**15,620**	**3,285**	**10,895**	29,800
% of Flood Affected Area	**11.9%**	**4.5%**	**8.8%**	9%
Total Population (nos)	**17,670,100**	**2,519,900**	**2,012,600**	22,202,600
Population living in Flood Affected Areas (nos.)	**3,688,600**	**652,175**	**478,490**	4,819,265
% of Population Living in Flood Affected Area	**21%**	**26%**	**24%**	22%
Annual Average Damage (RM million)	**616.5**	**141.0**	**157.5**	915
AAD per sq. km. of Flood Affected Area (RM)	39,470	42,920	14,460	30,700

Source : Final Report on Updating of Condition of Flooding in Malaysia, October 2003 by Department of Irrigation and Drainage Malaysia

Lost of life, damages to properties and activities disruption were among types of damages due to flood experienced. Property damages caused by flood shown in Table 1 may include the damages of houses, infrastructures, vehicle, machines, crops etc. In specific on lost of human life, specific flood events and damages focusing on lost of human life summarized in Table 2.

Table 2: Specific flood events and damages caused by flood.

Event	**Area**	**Causes**	**Damages**
27 December 1996	Keningau	Heavy Rainfall by Tropical Storm "Greg"	• **170 killed** • 100 missing • 3000 people homeless • 300 homes damage
7 July 2005	Telipok	Heavy rainfall	• **3 killed** • 2793 families affected • School, commercial building inundated
6 & 7 January 1999	Moyog	Heavy and long duration of rainfall (La Nina phen.)	• **3 killed** • 1,106 evacuated • 5 Villages inundated • 23 schools closed

For flood in Telipok and Moyog, the accidents where the 3 are killed actually happened while they are trying to reach their home during the flood, thinking that the flood is not so risky. The details on how the accident happened summarized as the following.

Telipok Flood, 7th July 2005.

1. “The first body found was that of Tay Fui Teck, 50, at 6.30am at the hanging bridge at Kampung Masjid. He was believe to have been washed away by floodwaters while trying to get home.”

2. “A 13-year-old Timorese, Aji Minda Jumat @ Mimi, decided to walk home with 5 friends about a mile away. "They decided to form a chain by holding each other's hands. However, the girl slipped and was washed away by the floodwaters.”

3. “Golbertus Tomas, a cooking gas seller, is believed to have also taken the chance to walk home with his younger brother but was washed away by the floodwaters.”

Moyog Flood , 6th January 1999

1. Sikan Serianti, 55 was killed when trying to save his car in Kampung Kibatu, Penampang.

2. A body of Timorese man, believed to be in his 40s, was found on the roadside in Jalan Kampung Kolopis, Penampang.

3. Awangku Mohamad Hafiz Awang Bongsu, 2 years old, died after he fell into a drain near his home.

2.2 Present countermeasures to mitigate flood damages

The government of Malaysia through its agencies have implemented numerous flood mitigation projects as countermeasures to flood damages which consist of structural measures and non-structural measures.

For structural measures, projects that have impacts on flood can be divided into 3 types as follow:

- Flood mitigation and drainage projects by Department of Irrigation and Drainage (DID)
- Flood mitigation and drainage projects by local authorities
- Water Resources Projects

Land use planning for water resources such as development of Floodplain Management Plan, Conservation of wetlands, Flood forecasting and Flood warning system and public awareness on flood and its consequences are part of activities carried out as non-structural measures.

2.3 Importance of flood hazard map in Sabah, Malaysia

As structural measures that being implemented by the government cannot fully solve the flooding problem, human life and properties will still be exposed to flood risk. Human life lost that happened in the 3 flood events shown in Table 2 should have been avoided by human themselves. The absent of structured information on how to behave during the flood among the communities as one of the important factor to be considered. Flood hazard mapping as being used and practiced in Japan eventually can be adopted to overcome the issue. Nevertheless adoption of Flood Hazard Mapping will be more effective if implemented alongside with existing mechanism of flood management and damage prevention in Sabah such as the provision for Floodplain Management in the state water resources management context.
Sabah, as one of states in Malaysia, has it own jurisdiction on its' natural resources comprises the land, water and forest. With that, Sabah enacted its Water Resources Enactment 1998 for better management of it water resources but at the same time do provide provision for management of Floodplain Management Area. Under the enactment, declaration of such area need to be accompanied by a Floodplain Management Plan whereby the plan has to consist the following:

i. Description of the flood characteristic of the area and summary of technical investigations of flood behaviour;
ii. An evaluation of the economic, social and environmental consequences of flooding;
iii. **Measures for minimising the impact of flooding**;

It is recognised that, Flood hazard mapping objective which is to reduce or prevent lost of human life is coincide with one of the component of the floodplain management plan, measures for minimising the impact of flooding. With this scenario, it is felt that the development of flood hazard map for an area should be a complement to floodplain management plan for that area. By doing this, all **existing institution** established under the needs for water resources management can also be used for the development of flood hazard map for the area.

Figure 1: Schematic presentation on how Flood Hazard Map can be incorporated into existing mechanism

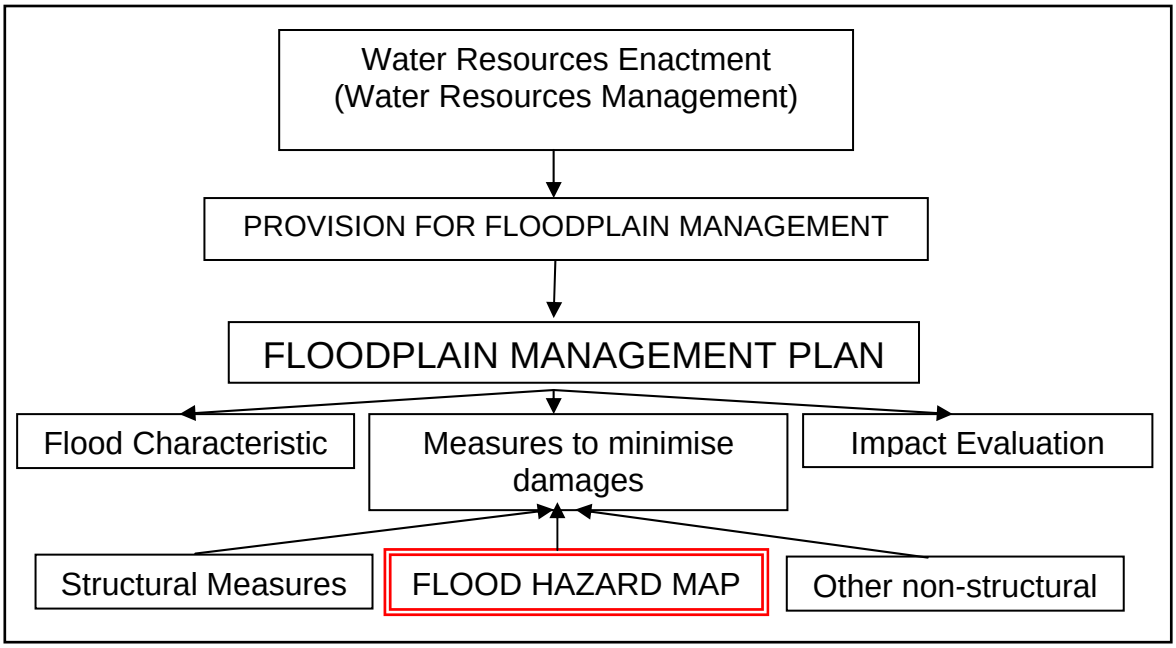


***Figure 1**: Flood Hazard Map as measures in Floodplain Management Plan*

3. The allocation of roles in publishing Flood Hazard Map in Malaysia

This chapter will basically introduce relevant government agencies in Sabah with their existing role which needed in the process of producing flood hazard map. In view that, the responsibility on water resources management in Sabah was put under the purview of the Department of Irrigation and Drainage (DID), the department should coordinate the development of flood hazard map in State level as it do to the management of floodplain area. Implementation in [1]district level, existing mechanism on water resources management in district level should be used. In water resources management in district level, the highest established committee is the District Catchment Management Committee (DCMC). This committee is headed by the District Officer.

The DCMC in the district level was assisted in terms of technical matter by a District Technical task Force which is headed by DID district. The detailed on allocations of role is summarized in Table 3 and 4.

3.1 Organisations that will be responsible in producing a inundation map

Table 3: Organisations role in producing inundation map

No	Task	Organisations	Existing Role
1	Coordination of process	• Dept. of Irrigation and Drainage	Head of District Technical Taskforce
1	Hydrological data	• Dept. of Irrigation and Drainage (S) • Dept. of Meteorological Services (N) • Dept. of Agricultural (S)	Hydrological data collection Hydrological data collection Hydrological data collection
2	Topographic data	• Dept. of Survey and Mapping (N) • Dept. of Land and Survey (S)	Topographic map (1:50,000) Height level in certain area

[1] District is a smaller administration unit where a state in Malaysia being divided. Administration in the district is headed by a District Officer.

3	Landuse map	• Dept. of Survey and Mapping (N) • Dept. of Agriculture (S) • Dept. of Forestry (S)	Aerial photo/Satellite Image Agricultural area map Forest Area Map
4	Numerical Simulation	• Dept. of Irrigation and Drainage (S)	

3.2 Organisations that will be responsible in producing/making and disseminate flood hazard map.

Table 4: Organisations role in making and dissemination of Flood Hazard Map

No	Task	Organisations	Existing Role
1	Coordination of Process	• District Office	Head of District Catchment Management Committee
2	Maps integration	• Department of Irrigation and Drainage	Head of District Technical Taskforce
3	Evacuation process and Centre	• Dept. of Social Services (S)	Providing relief in any disaster
4	Dissemination of maps	• District office	Secretariat for Head of Village and Residential Committee

* Dissemination process on the ground will be varied from district to district depends on establishment of community organisations.

In actual implement of the map for evacuation during disaster, the District Office with the highest administration role in district level cum chairman of district disaster committee can enforce any recommendation or order for evacuation.

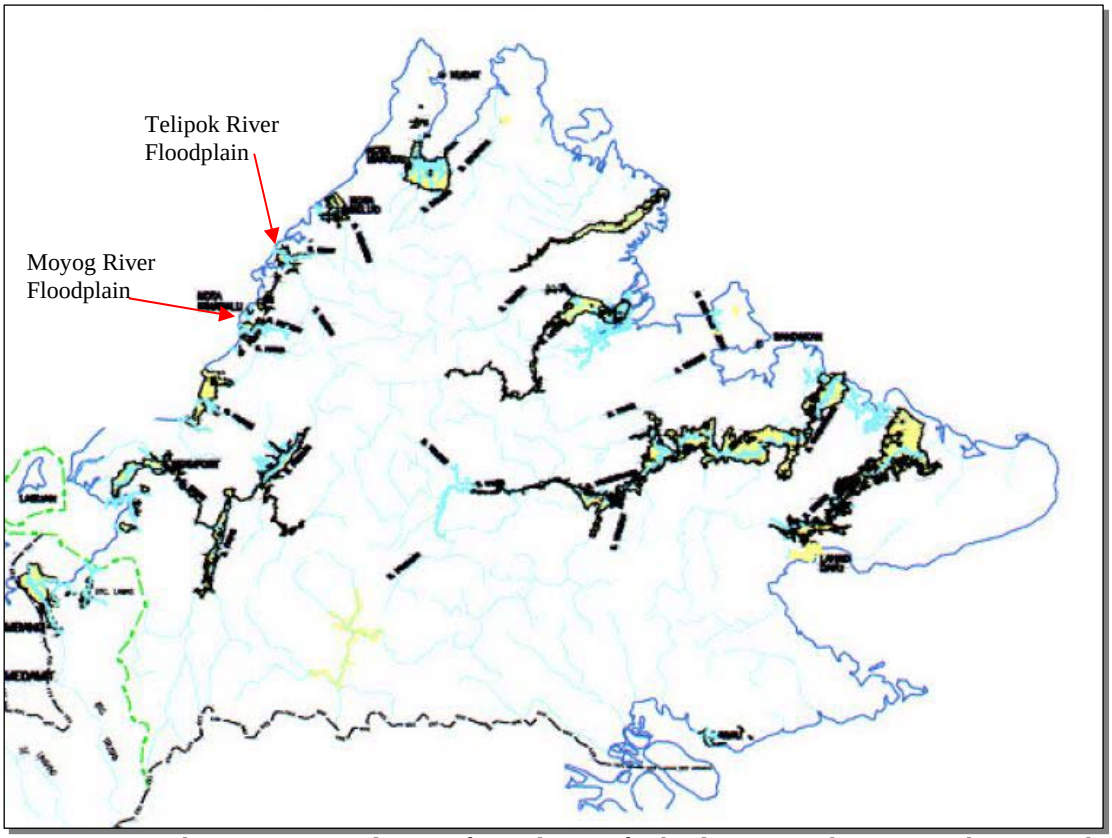
4. Action Plan

This chapter will discuss on the target area where development of flood hazard map proposed to be carried out focusing on why the area are chosen, availability of needed information and resources, 5 years action plan as well as the problems anticipated in making the flood hazard map.

4.1 Target Area

There are 2 proposed areas for the development of Flood Hazard Maps in Sabah. The proposed areas are **Telipok River Floodplain** and **Moyog River Floodplain**. Both area is shown in the map in the next page.

***Map 1**: Flooded areas in Sabah, Malaysia*



Source : Final Report on Updating of Condition of Flooding in Malaysia, October 2003 by Department of Irrigation and Drainage Malaysia

I. Telipok River Floodplain

As stated in the country report, this area has experienced flooding and the latest and view as one of the serious events is on July 17, 2005. During the flood, the highest daily rainfall recorded was 239.5mm, 195mm and 180.5mm at 3 stations in the proximity of the area. One of the stations recorded the highest rainfall intensity for 1 hour, 2 hours and 3 hours, which Annually Recurrent Interval (ARI) was deduced to be 41 years, 21 years and 16 years respectively. Damages caused by the mention flood were serious as being summarized in Table 2.


Daily Express

INDEPENDENT NATIONAL NEWSPAPER OF EAST MALAYSIA

Blueprint soon on solving flash floods in long term


Borneo Post - 22 Sept 2005

Rare rainfall caused flood

TELIPOK DISASTER: 239.5mm of rainfall recorded

Related Newspaper cutting an d photo

II. Moyog River Floodplain

Moyog River Floodplain has also experienced flood and one of the serious flood occurred in January 1999 which caused by a heavy rainfall in that area due to the La Nina phenomena. Damages caused by this flood are as summarized in Table 2. Evacuation of communities within the area are due late which believes caused by situation whereby no serious flood occurred for quite a long time.

***Photo 2**: Evacuation by boat was used due to the late evacuation of the community*

4.2 Data and resources availability

Data and resources availability are summarized as follows:

Data/Resources	Telipok River Floodplain	Moyog River Floodplain
Hydrological data	3 rainfall station and 1 flow station	2 rainfall station and 1 flow stations
Topographic data	• Topo map 1:50,000 • Some ground survey data used for development project. (Road, development in floodplain)	• Topo map 1:50,000 • Some ground survey data used for development project. (Road, development in floodplain) • Ground survey are possible to be carried out under FMP study budget
Aerial photo/Satellite image	• None	• None • Possible to be bought under FMP study budget.
Budgets	• None • Government proposed for a blueprint/management plan.	• Proposed for Floodplain Management Plan Study to State Finance Ministry.
Numerical model	• No in house experience staff	• No in house experience staff

4.3 Action plan within 5 years

Foreseeing that 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	Proposed Action Plan	Expected Output
2006	• Coordination for FHM at National Level • Awareness of the needs for FHM • Coordination for the implementation of study in either area • Management of study (Floodplain Management Plan development with FHM incorporated)	• Networks at national level established. • FMP Study started • Awareness to stakeholders on importance of FHM
2007	• Management of study (cont') • Establishment for possibilities to carry out Floodplain Management Plan Study in house for sustainability and expedite coverage.	• FMP developed and disseminate with FHM incorporated • FMP study in other area started
2008	• Coordinate FMP development for 1 other possible area	• Betterment of FMP
2009	• Coordinate FMP development for 1 other possible area (cont')	• FMP with in house resources developed
2010	• FMP review	• Reviewed FMP

4.4 Problems

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

i. Insufficient data (hydrological and topographic)

It is recognised that numerical simulation at best possible is one of the most important part of flood hazard mapping. In Sabah, installation of gauging station to capture hydrological information have yet 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 utilised as best as it can.

ii. 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 organisation to carry out this is also a possibility.

5. Suggestions for making this training course more meaningful

i. 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.

ii. Ex-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.

6. Concluding remark

As mentioned earlier, Flood Hazard Mapping will be definitely beneficial to the management and reductions of damages caused by flood in Malaysia generally and Sabah particularly. Since flood hazard mapping has yet being carried out in any part of Sabah, this training course has provide the opportunities for government of Malaysia to enhance its flood hazard map and for Sabah 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.