

Flood Control, Riverbank Erosion, River Works, Flood Forecasting and Warning System in Lao PDR

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ABSTRACT: The development of hydrology and water resources in the Lao People's Democratic Republic (Lao PDR) as well the other riparian countries in the Lower Mekong Basin namely Cambodia, Thailand and Vietnam has started since long and independently carried out. The above development has actively cooperated among riparian countries since 1957 after established the Mekong Committee (MC) one of inter-government organization. From 1995 the name was changed to the Mekong River Commission (MRC). The areas of development and cooperation are wide, that why in this report will consider just on flood control, riverbank erosion, river works, flood forecasting and warning system only. With financial assistance from donors and effective cooperation the development of hydrology much improved by using telemetering equipment for transmit an accurately and real time data

1 INTRODUCTION

Lao People's Democratic Republic is a land locked country of 236,800 sq km in which mountain covered 80% of total land area with a small population of 5.2 million (2000). The Country situated in South East Asia, bordering with China, Myanmar, Thailand, Cambodia and Vietnam.

The Lao PDR geographically it located between 14° to 22° N latitude and between 100° to 108° E longitudes. The northern part of the country is made of deeply dissected plateau at altitudes of more than 1,500 m above sea level. The Mekong valley stretch southwards along the Anamite chain and from two plains: the plain of Vientiane and the plain of Savannakhet.

The country is located in the warm, tropical climate zone characteristic of the most of South East Asia monsoon. The weather is influenced by monsoons and by the inter-tropical front and cyclic storm, which divides the year into clearly defined wet and dry periods. The wet season from May to October, when the southwest monsoon prevails, which carries moisture up from the gulf of Thailand and deposits heavy rainfall on the western slopes of the Anamite Chain. The mountain peaks receive the most rain, more than 3000 mm a year. The temperature of this period is varying from 24°C to 38°C. A dry season under the influence of the northeast monsoon runs from November to April. The driest month of December, January and February are also the coolest, when the temperature may drop as low as 15°C. In March, the weather hot up and the temperature rise to reach a maximum of around 38°C at the very end of the dry season. Annual rainfall for all over Laos is about 1700 mm.

2 FLOOD CONTROL

Flooding of the Mekong river and its tributaries are recurrent events and cause each year in varying degree damage to agricultural production, rural infrastructure and human settlement, which can reach disastrous proportions with serious losses in food production and human lives. The floods occur during the monsoon period from August till November and are caused by heavy tropical storms and typhoons originating in the Chinese Sea.

In the Mekong River, the ratio between low flows and flood discharge is approximately 50. Years with severe floods were 1961, 1966, 1971, 1978, 1984 and 1994.

The 1995 and 1996 floods were exceptionally serious. An analysis of flood levels of the Mekong River over the past thirty-five years shows that only in 1961 and 1966 similar flood levels were reached. The floods of recent years show an upward trend and 1994, 1995 and 1996 flood levels were well above average. Losses in agricultural production were substantial, and particularly exceptional in 1995 and 1996.

In 1994 flooding by the Mekong River in Laos damaged about 28,000 hectares of cropped land. The floods of 1995 and 1996 were the worst since 1966, and seriously affected the agricultural areas along the Mekong and its tributaries in the

Vientiane Municipality, Vientiane, Bolikhamxai, Khammoun, Savannakhet and Champasak Province. Up to 87,300 hectares were inundated in 1995 and 76,000 hectares in 1996. Considerable damage was caused to irrigation and other infrastructure, as well as about 260 hectares of fishponds were destroyed.

The Laotian Government responded swiftly to the emergencies arising from the 1995 floods. It requested FAO assistance to address the recurrent flood problem and to define options for flood loss prevention as well as a strategy for flood management for its vulnerable agricultural sector.

The importance of this situation to the Lao PDR cannot be denied. It is vulnerable to the devastation of flooding, and lacks the resources (financial, technological and human) to adequately defend itself. Obviously, agricultural and rural development has a high priority for the government of Lao PDR, and it is the policy of the Lao Government that the Lao National Mekong Agreement strives to uphold, in accordance with the Socio-economic Development Plan.

Annually, many problems related to floods still remain for which we do not have enough knowledge, experience or capital to tackle in order to develop a more stable agriculture in the Lao PDR.

2.1 Non-Structure measures

The Prime Minister has set up the National Hazard Defense Committee (NHDC), which is responsible for national flood and drought defense in general, in co-operation with line agencies concerned, locally and abroad.

Until 2000 the Prime Minister has set up a Flood Defense Committee (FDC) chaired by the Minister of Agriculture and Forestry. The two vice chairmen are:

- General Director of the Department of Irrigation, under the Ministry of Agriculture and Forestry (MAF),
- General Director of the Department of Meteorology and Hydrology, under the Ministry of Agriculture and Forestry (MAF),

The main objectives of this Committee are as follows

- To organize and manage the flood defense activities;
- To make plans and strategies for flood defense;
- To prepare budgets, equipment, materials and manpower for flood defense.

To carry out the above tasks, the chairman of the committee had set up a working group, which consist of members from government agencies concerned:

- Representative of the Department of Electricity, under the Ministry of Industry and Handicraft (MIH),
- Representative of the Ministry of Labour and welfare,
- Representative of the Electricité du Laos, State Company, under the Ministry of Industry and Handicraft,
- Representative of the Cabinet of the Ministry of Agriculture and Forestry,
- Representative of the Waterways Administration Division, under the Ministry of Communication Transport Post and Construction (MCTPC),
- Representative of the Water Resources Co-ordination Committee (WRCC) under the Cabinet of Prime Minister office,
- Representative of the Nam Ngum Dam, under Electricite du Laos

2.1 Structure measures

Over the past three decades a more permanent option to reduce the destructive effects of floods is desirable. Therefore, long-term investments in various types of flood defense works are required, which may include:

Flood protection levees and flood defense gates are needed all along the Mekong River to protect the cities and the low-lying agricultural areas of the Vientiane Municipality, Paksane, Thakhek, Sannakhet and Pakse that are inundated by each flood.

In 1994 under European Community Flood Protection Programme 74 km long of the first flood protection dike (Road dike) and flood control gates have been constructed along the Mekong River at the Vientiane Municipality with top elevation is 172.00 m (mean sea level, Kolak Station, Thailand).

In 2002, the Secondary Towns Urban Development under ADB Project, 5000 m of the flood protection dike and some of the water gates have been constructed along the Mekong River at Pakse City.

3 RIVER BANK EROSION

Mekong River flows through Laos territory is 1,600 km, it starts from Friendship Triangle where China, Lao and Myanmar border then to the Golden Triangle where the borders of Laos, Myanmar and Thailand meet. This area marks

the division between the Upper and Lower Basins and it is here where the Mekong River Commission mandate begins.

The River then marks the border between Laos and Thailand for around 100 km before running inside Laos for some 500 km before once again marking the Lao border with Thailand just upstream from Vientiane. The River again runs inside Laos just upstream of Pakse and down to Laos Cambodia border.

The river flows through the lowland areas consist of alluvial deposits, unstable and tends to meander and erode the bank.

The destructive phenomenon of the Mekong River bank erosion is occurring in many locations, especially in the river bend and lowland area. Severe erosion of the bank of the Mekong River has threatened the infrastructures such as road dike, water gate, electric poles, industrial premises, temples, schools, houses, agricultural land and communities.

3.1 Bank erosion

The bank erosion in Lao PDR is shown in Table 1.

Table 1. Summary of bank erosion

Items	Location	Seriously eroded	Lightly eroded	Total (m)
		Length (m)	Length (m)	
1	Luang Nam Tha	-	-	-
2	Bo Keo	22,750	3,600	26,350
3	Udomxay	-	-	-
4	Luang Prabang	-	-	-
5	Vientiane	6,000	8,800	14,800
6	Municipality	54,200	10,200	64,400
7	Bolikhamxai	5,500	24,400	29,900
8	Khammoun	3,000	12,200	15,200
9	Savannakhet	-	18,600	18,600
10	Salavan	400	900	1,300
11	Champasak	1,500	3,000	4,500
Total		93,350	81,700	175,050

Source: Waterways Administration Division, June 2001

3.2 Bank protection

The bank protection work was officially commenced in 1988 with financial assistance from AusAID for Mekong River bank protection at Thadua and Wat Muangwa, Wattay in 1995-1996. The method and construction materials as well as gabion, reno-mattresses and geotextile were imported only rocks from local materials.

In 1996 the European Union was funded 385,000.00 US Dollars and combined with national budget for protection of 420 meters of bank erosion at Hat Dok Keo downstream of Vientiane by using imported construction materials as reno-mattresses (6m x 2m x 0.30m) and geotextile only rock from local material.

In response to the request of the Lao People's Democratic Republic the Government of Japan decided to conduct the Study on the Mekong River bank protection around Vientiane municipality through the Japan International Cooperation Agency.

The objective of the Study was to formulate a master plan of riverbank protection of Mekong River in Vientiane Municipality and to transfer technology to counterpart personnel in the Study.

The Study was carried out by Infrastructure Development Institute-Japan (IDI) in 1999 through the Mekong Riverbank Protection Pilot Construction/Soda Mattress at Wat Sibounhuang site in 1999-2001. The monitoring of this Project was carried out one year after construction and the out put/result of this study will apply for make up a Master Plan.

Based on the result of the above Study, the first Master Plan for the bank protection in the Mekong River at the Vientiane Municipality is under studying. In combination between theory and practice, in this year 800 m of bank protection will be constructed at three sites: Sibounhuang, Chomcheng and Dongphosi by using new technology of Soda Mattress one of traditional Japanese bank protection method. The Maser Plan will complete in October 2004.

In view of the cooperation and technology transfer, the JICA experts to the MCTPC incorporation with WAD carried out the bank protection by using Groyne at Ton Peung District, Bokeo Province in the North of Laos and Ban Pakkadan,

Kham Moun Province about 200km from Vientiane in the South.

Beside the method mentioned above the JICA expert incorporation with the National University, the faculty of forestry carried out willow plantation for bank protection. The experiment was taken at the Mekong riverbank at Km 4 down stream of Vientiane and the study is on-going.

The construction of bank protection also has done by the owner of land and private sectors at many areas with difference levels and methods.

3.3 *Types of bank protection in Lao PDR*

- Dump rock
- Rock riprap
- Rock riprap with cemented
- Wooden pile
- Gabion and Reno mattress baskets
- Groynes
- "Soda" mattress:
- Vegetation (Willow)

4 RIVER WORKS

Waterways Administration Division (WAD) under Department of Roads to responsible for planning, management and maintenance of river works. Main responsibilities are:

- Navigation improvement
- Port development
- Bank protection
- Water resources management and environment

One of Project under navigation improvement plan, which WAD under taking, is Upper Mekong river Channel Improvement Project among China, Laos, Myanmar and Thailand.

The official Inauguration Ceremony for Commercial Navigation on the Lancang-Mekong river among China, Laos, Myanmar and Thailand was held on 26 June 2001. It is convinced that the official opening of the commercial navigation on the river and navigation channel improvement thereof in particular will promote the development of transportation, tourism, energy, economy and trade as well as human resources development in sub-region. It will play a positive role in promoting the economic development and social progress in the sub-region, thus greatly benefiting the people along the river.

The Lancang-Mekog river from China-Myanmar Boundary Marker 243 to Ban Houei Sai of Laos (331 km) is an unregulated and developed natural navigation channel. River in this section is navigable the year round provided that special devices are available to haul the boats across difficult shoals and rapid.

Navigation is hampered and hinder by swift/strong currents, narrow/rocky passages and meandering channel during the dry season and least available water depth is stricted due to shallow passages. Navigation is restricted draft of 0.5-0.8 m during the low water period, the river is navigable with small boats 15 T (country boats) and up to 35-50 T during the high water season.

The purpose of the project are to improve the navigational conditions, to safeguard the safe navigation of vessels, to reduce the losses of properties and levies and to mitigate pollution by fuel oil leakage due to the accident.

The main works of the Project are to regulate 11 rapids or shoals and 10 scattered reefs that seriously hinder navigation of vessels, installation of 6 winching facilities, 100 navigation marks and 106 navigation signboards.

The implementation of the Project and the vehicle's operation thereafter will result in positive and negative impacts on the environment along the River. Based on the investigation of the environment situation of the Project area, this Report forecasts the impacts on the environment through the analysis of the project impact and put forward the feasible measures of pollution prevention and ecological impact retardation.

The scope of assessment is as follows:

- Air quality, noise, and ecological environment;
- Analysis of hydrologic impact on discharge, flow velocity, water level, waterfront and thalweg after navigation channel improvement;
- Analysis of impacts on aquatic lives, especially fishes during construction;

- Analysis of social impacts.

During 3-13 April 2002, three of 11 rapids in the Upper Mekong section between Laos and Myanmar have been moved namely Keng Luang Tay, Keng nam Leui and Keng tang O by Guanxi Navigation Construction Company-China. The remaining of the rapids will continue move start from December 2002 to April 2003.

5 FLOOD FORECASTING AND WARNING

In view of the frequency of the floods, a good forecasting system is a necessity to improve the preparedness of the population to floods and to support evacuation plans. Since 1970 the Mekong Committee (now called Mekong River Commission Secretariat MRCS) is operating a flood forecasting system for the Mekong River during the flood prone months from July to October.

Waterways Administration Division (WAD) responsible to hydrologic net work specially for the main stream and navigable tributaries is as follows:

- | | |
|---------------------------------|---|
| • Rain gauge station | 21 stations |
| • Water level station | 51 stations |
| • Discharge measurement station | 28 stations (7 stations join with Thai) |

5.1 *Flood Forecasting and Warning Management*

- Conduct an annual flood preparedness forum,
- Set basin wide standards for collection, format and exchange of data, hydrological analysis and flood forecasting and warning,
- Set basin wide standards for flood warnings and response,
- Synergies national flood forecasting and warning system with MRC flood forecasting and warning,
- Strengthen MRC databases, to include more data and provide open access to member states,

5.2 *Forecasting and Warning Service*

- Reducing uncertainties,
- Increasing the lead time,
- Investigate medium and long-term forecasts techniques,
- Increasing the accuracy of forecasts,
- Improving the usefulness of forecasts,
- Improving dissemination,

5.3 *Flood forecast dissemination*

- Knowledge on information requirements for different of users,
- Riparian relations,
- Social and cultural issues,

5.4 *Linkages to other MRC Programs*

Flood preparedness, in particular flood forecasting and warning, and flood-proofing measures are complimentary. Implementation of flood forecasting and warning along with flood proofing would ensure the full benefits of flood proofing are forth coming.

The component is related to MRC activities such as:

- Flood forecasting and Early Warning system (FFEWS)
- Appropriate Hydrological Network Improvement Project (AHNIP)
- Inundation estimates and FF dissemination pilot project,
- Update and improvement of flood map,

Starting in July 2001, MRCS has issued daily flood reports through the Internet www. The reports were compiled from information received from line agencies in the member countries. In the 2002 flood season MRC continues to broadcast three-day forecasts with improved telemetering equipment that can transmit data directly to computer terminals in the Secretariat in Phnom Penh.

6 CONCLUSION

6.1 *Flood control*

Flood control in Lao PDR in view of non-structure measure and structure measure still in low level and flood return period very short. The Government has issued and upgraded of some policies, legislations and regulations concerning catchment management, reservoir operation, flood awareness and public participation, but those document were insufficiently implemented.

6.2 *Riverbank erosion*

The rate of bank erosion in the Mekong River is increased eventhough many places have been protected. The reason is when one side of the river has been protected so the erosion of the other side will be double. With the international assistance in term of funds and technology transfer, the bank protection in Lao PDR has a big step forward, but if we compare the ratio between the bank protection and bank erosion is still far.

6.3 *River work*

In the last decade the river work activities seem to be slowly developed. The development of the land road along the Mekong River made the high competition with waterway or river transportation, many waterway infrastructure were abandoned due to lack of budget for maintenance, improvement and poor marketing.

6.4 *Flood forecasting and warning system*

Flood forecasting and warning has been mainly dealt with on a national basis. The using of telemetering equipment for flood forecasting and warning system in the region was a big achievement of the hydrology networks in term of equipment and technology transfer. However, the sustainable development or the continuation of the project by generation to generation remains problem we are facing. The MRC and Government of the riparian countries are pay attention to this issue in term of strengthening of capacity building and sufficient budget to keep project going well.

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