ROADMAP MISSION FOR THE DEVELOPMENT OF FLOOD FORECASTING SYSTEM FOR THE MRC

(Preliminary Report)

1. INTRODUCTION

Following MRC Council's acceptance of a Flood Management and Mitigation Strategy (November 2001), it was decided to establish a permanent "Flood Management and Mitigation Program" in November 2003. A major component is to establish a Regional Flood Forecasting Unit within the Regional Flood Management and Mitigation Centre (RFMMC) in Phnom Penh. On a day-to-day basis during the flood season, the Centre provides real time flood forecasts along the mainstream of the Mekong River from Chiang Saen near the border with China to Chau Doc, just above the Lower Mekong Delta in Vietnam.

During April and May of this year, the Centre's management with international consultants visited line agencies in Cambodian, Laos PDR, Thailand and Vietnam and MRC Head Office in Vientiane.

The objectives of the Mission were to assess:

- The current status of the systems and capabilities of the national forecasting and warning Centres in Thailand, Vietnam, Cambodia and Laos;

- The adequacy of the current services provided by the RFMMC to the national Centres; and

- The actions the RFC have to undertake to serve the national flood forecasting and warning Centres in terms of data, information and systems, now and in the next 5 years.

There will be two presentations at this Forum which will present the key conclusions from the Mission and how these will impact on the future of the Centre.

One will focus on the institutional matters leading to a fully operational forecasting system by 2009 and the criteria required to hit that target and the other will outline the technical issues associated with the current MRC's forecasting systems and the technical components required in the next few years to get a fully operational system by 2009.

This paper contains a summary of the key conclusions of the both components.

2. STATUS OF EXISTING SYSTEMS

The Mission was required to examine the institutional and technical arrangements in:

1) The member countries agencies having involvements in issuance of flood forecasts and warnings within their national boundaries; and

2) The Mekong Commission's Regional Flood Management & Mitigation Centre in Phnom Penh for providing forecasting and early warning information in the Lower Mekong Basin.

This summary does not intend to focus on the national Centres in detail but to direct attention to how the forecasting products and services provided by MRC's RFMMC can add value to information used by member countries in warning and response actions. However, a snap shot of the situation in each country, as assessed by the Mission Team, is provided as background.

2.1. Member Countries

In each of the member countries considerable variations were evident in the systems, resources applied and facilities. Nevertheless each produce forecasts acceptable to the agencies charged with issuance of flood warnings. Apart from Thailand which accepts the MRC mainstream forecasts for decisions.

Cambodia, Laos PDR and Vietnam use MRC forecasts only as a check of their own. There are experienced forecasters in each country but in several centres, dependencies on limited resources, people and systems, are evident. This creates levels of risk that they are aware of, which should be addressed. Cambodia and Laos PDR forecast for locations along the mainstream only from China to lower end of their sovereign boundaries.

Vietnam forecasts for downstream locations on the mainstream and situations in the Delta. The forecasts are basically limited to between 1 to 3 days. Because of the characteristics of the Mekong Basin, the accuracy of these short-term mainstream forecasts is relatively good.

Thailand's main forecasting efforts are directed to flash flooding on Thailand's major tributary streams and they rely on MRC forecasts for the mainstream.

The volume of observed hydrometric data, especially rainfall information, is very limited. Data is mainly restricted to mainstream stations with very limited information from tributaries.

Modelling systems vary from relatively simple Excel spreadsheets to proprietary packages such as FloodWatch and RiverWorks.

Most commonly used models are simple regression type models, which use observed upstream water levels to produce downstream forecasts. The type of modelling was applied along the main stream from Chiang Saen to Kratie.

Only Vietnam used hydrologic models, NAM, to estimate inflows into the mainstream. These were then routed to Kratie using a hydrologic routing. However, they could only be considered as coarse models given the limited available inputs and the lumped nature of the models themselves. Given the size of the tributaries and their times of concentration, rainfall is considered to have a limited impact the accuracy of short-term forecasts

Hydraulic models are not used in real time for the mainstream reach above Kratie. Vietnam used both regression models and hydraulic models for the delta area.

All countries suggest that the RFMMC should take the lead and produce medium term forecasts (6 to 15 days) for the Basin, for the mainstream, taking into account the modelling of the tributaries. They also indicated the extension of the forecasts to providing qualitative statements on impacts would be extremely useful and add considerable value in their management of warning alerts and other responses. The countries are also critical of the delays involved in the on forwarding of upstream data through the RFMMC although the mission team identified.

Perhaps, the most telling issue for RFMMC was that there is only limited acceptance of MRC forecasts, due to legal constraints and technical differences in the methodologies used to generate forecasts.

2.2. Regional Flood Management and Mitigation Centre

The main conclusion on the effectiveness of RFMMC's flood forecasting functions is that the Unit suffers in similar ways to several of the member countries, in that dependencies on limited resources, people and systems, are evident. The forecasters have limited experience but produce

daily forecasts using systems and models which have been in place for over 30 years. Documentation on the parameters and accuracy of the models are not available and the models are outdated.

Similarly to member countries, the data available to the RFMMC limits its ability to provide any more than short-term forecasts using relatively simple models. While the Centre uses the SARR model to produce inflow estimates from Chiang Saen to Pakse, the coarseness of the models and validity and accuracy of the rainfall inputs (both observed and forecast) cast significant doubts about the validity of the tributary inflows. Downstream of Pakse, a regression model similar to those used by Lao and Cambodia are applied along the reach to Chau Doc/Tan Chau.

The processes applied in generating the forecast are very manual, relying heavily on the manual collection and processing of observational data. Thus timeliness in the provision of data and forecasts is seen to be a problem by member countries.

The review team also identified that the discharge forecasts provided by the RFMMC were of limited value and that there were no feedback mechanisms to resolve differences in RFMMC and country forecast. This could potentially a source of major confusion for those agencies using the flood forecasts.

A major flaw in the relationship between the forecasters in each of the member countries was the lack of any mechanisms to resolve differences in forecasts.

If MRC were to move from short term forecasting (1 to 5 days) into medium term (6 to 15 days) there are a number of policy decisions involving institutional and technical matters which need discussions, negotiations and eventually application.

3. DEVELOPMENT OF NEW SYSTEMS

Policy and technical decisions have to be made on short term and medium term forecasting.

3.1. Short Term Forecasts

In the light of the low acceptance level, the first decision required is whether MRC should continue to provide 1 to 5 day forecasts. The Mission Team considers that the appropriate institutional and technical actions would be:

1. Continue to issue the 1 to 5 day forecast until the medium term forecasting system is fully operational;

2. Do not enhance the existing modelling system;

3. Improve the Web Site formatting for the dissemination of the forecasts;

4. Improve the efficiency of existing data collection and on-forwarding processes;

5. Initiate training of existing GIS and management personnel in preparing the 1 to 5 day forecasts to reduce the current dependency risk on the existing limited number of suitably trained forecasting personnel.

The quality and quantity of hydrometric data currently available for flood forecasting is probably adequate for the provision of short term forecasts. Data is limited to about 20 stations on the main stream providing daily observations of rainfall and water level. Real time or near real time observational data for the tributaries is very limited. Some spatial estimates of observed and

forecast rainfall, which is used in the SARR model by RFMMC, is of doubtful validity and limited value in short term forecasting.

Additionally, the models and modelling platforms currently in use are appropriate for the amount of real time data available and generally meet the requirements for the provision of short term forecasts. In general regression type models are used by Lao PDR and Cambodia to produce short term forecasts. In Vietnam, a combination of NAM models, flood routing models and hydrodynamic models have been adopted. The RFMMC derives its forecast from a combination of the SARR model and regression models.

There would be NO significant advantages to be gained in terms of lead time or forecast accuracy by applying more sophisticated models to existing data.

3.2 Medium Term Forecasts

For the MRC's RFMMC to produce medium term forecasts it is proposed to move forward in stages.

Increases in the volume of data and efficiencies of its collection are critical to the development and improvement of the RFMMC flood forecasting system. The quality and quantity of hydrometric will need to be significantly increased for lead times to be extended. At present, while the amount of water level information on the main stream is adequate, the rainfall information, particularly in the spatial definition in the tributaries, is grossly inadequate.

It is this paucity of observed rainfall and water level data, especially in the tributaries, which is considered to be the biggest hurdle in moving from the current practice to the provision of medium term forecasting for the mainstream.

Stage 1 will concentrate on agreements from the national agencies in each country.

Stage 2 will concentrate on developing an operational data base to be installed within the RFMMC in Phnom Penh and development of the data management systems to be used.

Stage 3 involves the selection acquisition, installation and calibration of a suit of models and modelling system, which will be used to forecast medium term forecasts. It will be important that the selection of the model has due regard to the data sets available.

With good collaboration from the national agencies in provision of data and work commencing almost immediately, Stages 1 & 2 might be in place by mid 2008.

Stage 3 commencement is a milestone. Prior to initiating action on selection of a model, an assessment has to be made as to how well the data collection phase is progressing. If there is reluctance within national agencies to provide data or data provision is not effective, the MRC and Donors will need to review how the program should then proceed.

If data collection is proceeding well and the model selection starts by mid 2008, the Regional Flood Forecasting Unit in RFMMC could be fully operational to produce medium term forecasts for selected locations on the mainstream by 2009.

Further enhancement of the system with the development of the impact assessment module might be considered following the successful completion of Stage 3.

To move from providing short term 1 to 5 day forecasts to producing medium term forecasts of 6 to 15 days it is envisaged that the Regional Flood Centre will require additional staff with system development skills with international specialist experience in the development stages. Eventually

additional 2 staff members will be required when the centre is fully operational. These are basically two new forecasters to provide adequate trained personnel every day during the flood season.

3.4. Long Term Forecasts

During these first two stages, the Centre will not undertake any work to produce long term forecasts (one month to season). This issue should not be considered before 2009 after the successful implementation of the medium term forecasts.

4. CONCLUSIONS

The systems of producing short term forecasts in each of the member countries and in the RFMMC are considered appropriately matched to the amount of data that is currently available. The ability of the models to produce more accurate and longer term forecasts is limited by the quality and quantity of the available hydrometric data.

At the current time, there is unlikely to be any significant improvement in forecast accuracy and lead times that would result from the introduction of sophisticated models.

The initial focus of the RFMMC should be on improving the quantity and quality of real time or near real time rainfall and water level data. Only after this occurs will models be able to produce accurate medium term forecast.

The Summary is prepared for FMMP by the Road Map Mission (T. Malone and W. Martin).