

# Council Study

## Draft Working Paper

### Development Scenarios for the Flood Protection and Floodplain Management

#### Communication and coordination:

During the 5<sup>th</sup> Regional Technical Working Group meeting the FMMP committed to make additional efforts into communication and coordination with all Member Countries, but particularly with Thailand. FMMP organized a dedicated meeting with TNMC on 10 September 2015 in Bangkok, Thailand with the following objectives: 1) Present and discuss Flood Protection & Floodplain Infrastructure (FP&FPI) theme of the Council Study, 2) Present and discuss the scope of the FMMP Initial Studies, and 3) Agree on the follow-up activities.

Furthermore a Regional Technical meeting was organized by FMMP with the objective to present the FMMP Development Scenarios for the Council Study and the data requirements for the thematic area FP&FPI on 4 November 2015 in HCMC, Viet Nam.

#### Overview of data collection:

Table 1: Overview of collection of data

Dataset	Cambodia	Lao PDR	Thailand	Vietnam
<b>Flood protection works and flood plain infrastructure for 2020 and 2040</b>	Not prepared yet	Not prepared yet	Not prepared yet	Not prepared yet
<b>Flood damage data 1998 - 2007</b>	Available for IS districts Not yet available for remaining CS districts/provinces	Available for IS districts Not yet available for remaining CS districts/provinces	Not yet available for IS districts and remaining CS districts/provinces	Available for IS districts Not yet available for remaining CS districts/provinces
<b>Flood damage data 2008 - 2014</b>	Not yet available	Not yet available	Not yet available	Not yet available

#### Strategy to address data and information needs:

Significant data gaps regarding the thematic area for the future scenarios 2020 and 2040 could not be covered yet. In spite of the attempts made, no use could be made of the FMMP Initial Studies platform for the collection of data and information for the thematic area FP&FPI.

The following data gaps are identified:

1. Flood protection works and floodplain infrastructure
2. Flood damage data

#### **Ad 1. Data collection for flood protection works and floodplain infrastructure**

For flood protection works and flood plain infrastructure the following information is required (for the year 2020 and 2040):

- **Significant** increase of crest levels of embankments/dikes/levees, expansion of the length of embankments/dikes/levees, and construction of new embankments/dikes/levees
- **Significant** expansion of the network of highways and national roads, construction and expansion of ring roads around cities and towns
- **Significant** land-use changes through landfills
- **Significant** sized new irrigation structures (with incorporation of flood protection)
- **Significant** expansion of urbanization in floodplains

Matrices have been developed for the data and information needs and agencies have been identified for the FP&FPI data and information needs.

<b>Cambodia</b>		
a. National level embankments/dikes/levees, including irrigation systems (check combination with roads)	Ministry of Water Resources and Meteorology; Department of Advanced Engineering	
b. Provincial level embankments/dikes/levees, including irrigation systems (check combination with roads)	Provincial Department of Water Resources and Meteorology	
c. National roads/highways (check relation with dikes)	Ministry of Public Works and Transport	
d. Provincial /rural roads (check relation with dikes)	Provincial Department of Public Works and Transport	
e. Municipal ring roads	Municipal Department of Public Works	
f. National irrigation schemes	Ministry of Water Resources and Meteorology; Irrigation Department	to be coordinated with Irrigation Thematic Team
g. Provincial irrigation schemes	Provincial Department of Water Resources and Meteorology; Irrigation Department	to be coordinated with Irrigation Thematic Team
h. Land-use change/landfills	Ministry of Agriculture, Forestry and Fisheries	Ministry of Land Management, Urban Planning and Construction to be coordinated with Agriculture Thematic Team

<b>Lao PDR</b>		
a. National level embankments/dikes/levees, including irrigation systems (check combination with roads)	Department of Roads	Department of Irrigation
b. Provincial level embankments/dikes/levees, including irrigation systems (check combination with roads)	Provincial Department of Public Works and Transport	Provincial Department of Agriculture and Forestry
c. National roads/highways (check relation with dikes)	Department of Roads	
d. Provincial /rural roads (check relation with dikes)	Provincial Department of Public Works and Transport	
e. Municipal ring roads	Municipal Department of Public Works and Transport	
f. National irrigation schemes	Ministry of Agriculture and Forestry	
g. Provincial irrigation schemes	Provincial Department of Agriculture and Forestry	
h. Land-use change/landfills	Department of Land Use Management	

<b>Thailand</b>		
a. National level embankments/dikes/levees, including irrigation systems (check combination with roads)	Royal Irrigation Department	Department of Water Resources
b. Provincial level embankments/dikes/levees, including irrigation systems (check combination with roads)	Regional Irrigation Department	Provincial Department of Water Resources
c. National roads/highways (check relation with dikes)	National Highway Department	
d. Provincial /rural roads (check relation with dikes)	Provincial Roads Department	Provincial Department of Land Development
e. Municipal ring roads	Municipal Department of Roads	Provincial Department of Land Development
f. National irrigation schemes	Royal Irrigation Department	
g. Provincial irrigation schemes	Regional Irrigation Department	
h. Land-use change/landfills	Provincial Department of Land Development	

<b>Viet Nam</b>		
a. National level embankments/dikes/levees,	Ministry of Agriculture and Rural Development	Ministry of Transport

including irrigation systems (check combination with roads)		
b. Provincial level embankments/dikes/levees, including irrigation systems (check combination with roads)	Provincial Department of Agriculture and Rural Development	Provincial Department of Transport
c. National roads/highways (check relation with dikes)	Ministry of Transport	Ministry of Agriculture and Rural Development
d. Provincial /rural roads (check relation with dikes)	Provincial Department of Transport	Provincial Department of Agriculture and Rural Development
e. Municipal ring roads	Provincial Department of Transport	
f. National irrigation schemes	Ministry of Agriculture and Rural Development	
g. Provincial irrigation schemes	Provincial Department of Agriculture and Rural Development	
h. Land-use change/landfills	Provincial Department of Natural Resources and Environment	

The level of data and information required is high, however simplification of required actions will be needed in order to aim at “significant” flood protection and floodplain infrastructure only. Prioritization of the most relevant/significant flood protection and floodplain infrastructure elements boils down to the required “significant” data and information of categories a – e in the matrices. The categories f – h in the matrices can possibly be retrieved through coordination with other thematic areas, even though the focus of other thematic areas is different and details required by the flood protection and floodplain infrastructure may not be “relevant” for other thematic areas. In the FMMP Council Study work plan the required data and information collection activities are further specified in terms of National consultancy inputs required, time and budget.

## **Ad 2. Data collection of flood damage data**

FMMP has been requesting data and information for the thematic area FP&FPI. Member Countries have approved providing available flood damage data from district level in the period 1998-2014. This has been accomplished through Memorandums of Understanding, Contract and Terms of Reference as part of the data and information requirements for the FMMP Initial Studies.

### **Description of scenarios:**

## **2007- Early Development scenario**

SWAT, IQQM and ISIS models are available for the 2007 situation for use by IKMP. These models will be checked and modified if necessary to incorporate any more recent improvements that have been made

to the model, for example to improve channel representation, that are not related to infrastructure or floodplain development.

## Proposed 2020 scenario

We would propose utilizing the existing 2014 ISIS model as used as the baseline for the FMMP initial studies project and update this model to 2020. The modifications relative to the 2007 Base condition include the following model updates carried out in 2014. FMMP will work with other thematic areas to define the development expected in terms of flood defense and flood plain development as these will be closely linked with the socio-economic development (urban expansion and change in flood exposure and thus damages) the agricultural developments on the floodplain (often irrigation development is accompanied by flood protection) and the impact of hydropower on flows and flood peaks and water levels in the mainstream affected by mainstream dams. The impact of changes in the river morphology in terms of bank erosion threats to flood infrastructure may also be part of the assessment if this does not already fall in the remit of other sector studies.

Table 2: Data and amendments required to produce 2020 scenario

Data and amendments required relative to 2007 Baseline Infrastructure	
<b>Upstream of Kratie (SWAT/ IQQM &amp; ISIS upstream model)</b>	<p>Collate data on levels of defences along mainstream corridor considering Flood Warning levels, Known Flood Improvements and Flood Events, data on hydrographic Atlas and onset of flooding along mainstream and in confluence areas relative to analysis of rated flow/level at gauging sites.</p> <p>For Damage Calculations assess Land Use Changes in Flood Corridor, people, assets and agriculture exposed in 2000 and adjust damage curves if necessary using recorded totals at province level.</p> <p>The upstream developments such as dam construction on tributaries are detailed by ISH.</p> <p>The floodplain infrastructure associated with Irrigation and agricultural/ aquaculture development within the corridor (as defined by other sectors). Embankments and areas of bank protection will be identified and used in the modelling and impact assessment for damages.</p>
<b>ISIS Flood Protection and Floodplain Infrastructure 2020</b>	<p>The 2020 development model should start from the 2007/2014 baseline model so that it incorporates the improvements made in modelling representation made since the early versions of DSF.</p> <p>Add or raise the representation of roads that were already raised by 2014 and upgraded to 2020 planned condition.</p> <p><b>Cambodia:</b></p> <p>Koh Pich development near Phnom Penh (modified channel);</p> <p>Roads surveyed for the 2014 model used under the FMMP Initial Studies; NR 6A, NR 8, NR 1 and NR 2 as detailed in FMMP Initial Studies reports;</p> <p>Phnom Penh Ring Roads already nearing completion in 2015 and expected urban expansion;</p>

	<p>Expanded Irrigation areas on the floodplain and likely associated flood protection.</p> <p><b>Vietnam</b></p> <p>The dike system in Vietnam for 2007 and 2014 models is as defined in the 2004 DSF model, so updating is needed based on level data and verification against satellite data of actual extents;</p> <p>The majority of salinity control gates should be removed;</p> <p>Consider if necessary to model Sea Dykes and Storm Surges (large event 1997).</p>
<p><b>Damage Data</b>  <b>1998 – 2007 and</b>  <b>2008 - 2014</b></p>	<p>The damage data has only previously been collated for districts of Cambodia and Vietnam downstream of Phnom Penh, and for Lao and Thailand in flood focal areas of Nam Mae Kok and Xe Bang Fai.</p>

- The model was updated in the Cambodian part to reflect new information including that for upgraded roads in the floodplain and around Phnom Penh. This incorporated results from a survey carried out in 2013 by Aruna Technology Ltd to capture level information for the banks along the river (frequency minor roads and in addition the survey of roads NR 6A, NR 8, 1 and NR 2 as detailed in FMMP Initial Studies reports.
- In 2014 the model also updated in the Viet Nam part by a National expert to improve the representation of a number of canals. Viet Nam model further updated to improve stability and accuracy of floodplain representation.
- The more recent flood control structures and raised banks present in Viet Nam have not yet been updated and will need to be included.

Any additional information provided by MCs, including development planned for the period between 2014 and 2020, will also be included however this information is currently lacking.

- In the upper part of the basin above Kratie information on flood infrastructure will be collected and collated along the mainstream for use in flood modelling and risk assessment.
- In the lower part there is still rapid change occurring but the current 2014 model probably needs updating only for a limited number of known changes in floodplain infrastructure such as the project currently ongoing in Cambodia to irrigate 300,000 hectares of rice fields in Prey Veng, Svay Rieng and Kampong Cham provinces which should be included as there may be transboundary impacts on flooding.

## Proposed 2040 scenario

The draft development plans for 2060 formulated as part of Task 3 of the FMMP Initial Studies project have been used to formulate a 2040 scenario for 2040. After completing the simulation runs to assess the impact of this scenario on flood behaviour, FMMP will be able to identify plausible flood protection infrastructure for the 2040 scenario. At present FMMP envisages running a number of sub-scenarios for other thematic areas to assess the specific impact in terms of flood damages.

The proposed 2040 scenario will include:

- *Expansion of Urban Centres*
  - Upstream Centres above Pakse such as Chiang Saen, Luang Prabang, Vientiane, Nong Khai, Nakhon Phanom, Thakhek, Mukdahan Khong Chiam
  - Middle reaches Pakse, Stung Treng, Kratie
  - Tonle Sap Kampong Chhnang, Kampong Thom, Siem Reap, Battambang, Sisophon
  - Cambodia Floodplain Phnom Penh, Ta Khmao, Takeo, Kampong Cham, Prey Veng
  - Vietnam Delta Chau Doc, Tan Chau, Long Xuyen, Cau Lanh, Can Tho, My Tho, Rach Gia, Soc Tran, Vinh Long etc., compatible with Mekong Delta Plan (2013).
- *Upgrading National Road Networks*
  - NR 1, NR 2, NR 3, NR 4, NR 5, NR 6, NR 7 in Cambodia
- *Ring Roads around Phnom Penh*
  - Second Ring Road (2040)
  - Third Ring Road (2060)
- *Expansion Industrial Areas in Cambodia*
  - Expansion along NR 3 and NR 4 towards southwest
  - Areas in Vietnam as proposed in Mekong Delta Plan.
- *Conveyance Corridors*
  - Corridor linking Mekong - Tonle Sap
  - Corridor towards Svay Rieng
  - Relief corridor to Gulf of Thailand
- *Irrigation Schemes*
  - Around 500,000 hectares of floodplain to be defined by Sectoral studies and locations to be decided
- *Move towards intensive agriculture with flood protection*

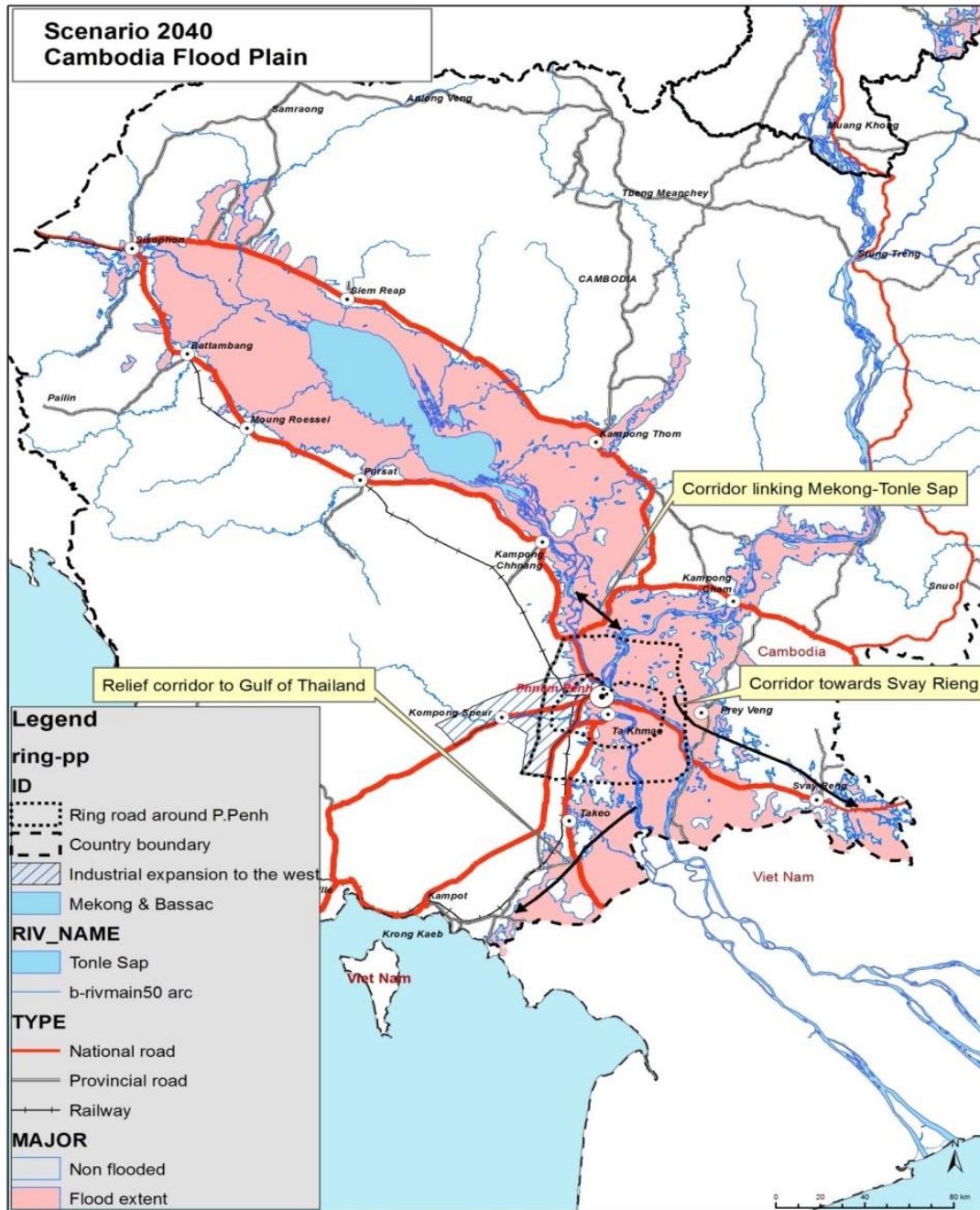


Figure 1: Scenario 2040 for Cambodian Floodplains



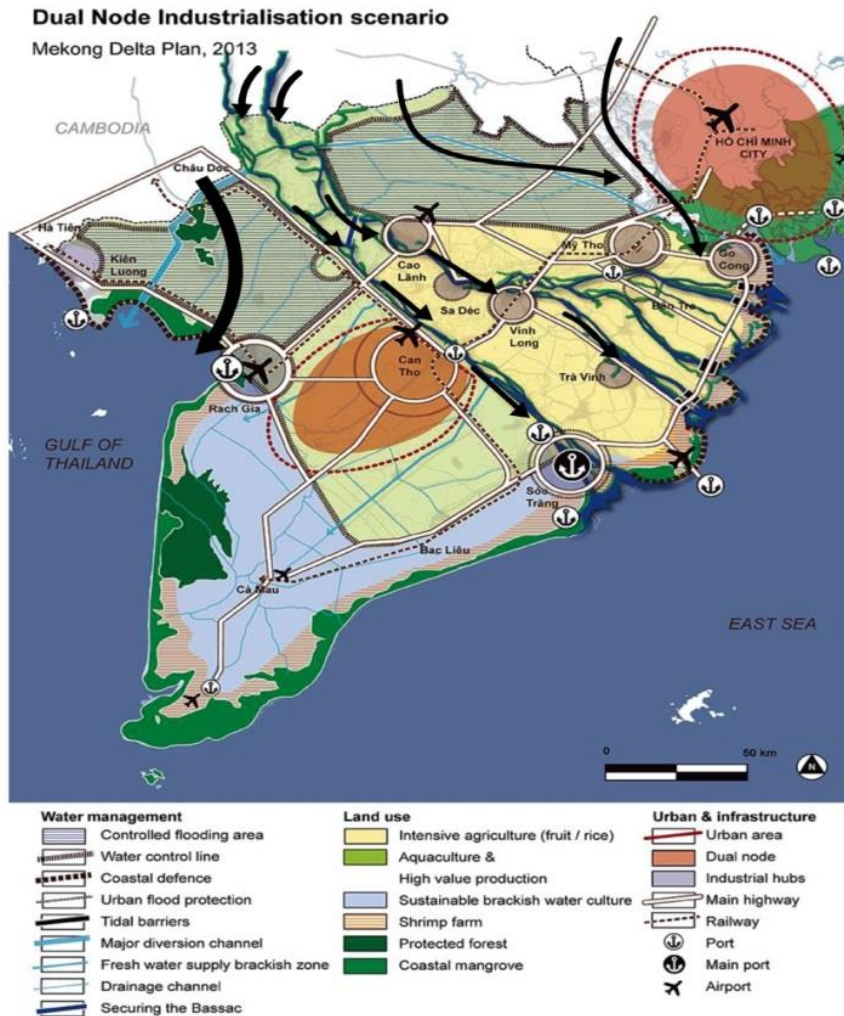


Figure 2: Scenario 2040 to be deduced from Mekong Delta Plan, 2013

## Decision from the 6<sup>th</sup> RTWG Meeting

Member Countries agreed that 2020 and 2040 development scenarios for flood protection will not be formulated until after the impact of developments from the other thematic areas have been assessed.