Council Study

Interim Thematic Assessment for Flood Protection & Floodplain Infrastructure

6th RTWG Meeting
Phnom Penh, Cambodia
17-18 December 2015

Contents

• Current status
• Development Trends
• Anticipated Impacts of developments
• Strategic Directions
• Next steps
Current developments

Driving forces behind a larger future flood risk:

1. **Floodplain developments**
   higher investment level, increase in population, change in economic activities, more built up area, high quality living area, loss of retention/storage volume for flooding

2. **Climate Change**
   larger maximum flows in flood season, sea level rise, resulting in higher flood levels, longer duration and larger extent
Ongoing loss of retention / storage volume in Cambodian floodplain / Mekong delta

Potential urban encroachment onto Cambodian floodplain
**Picture of 2011 Flood**  
(Recurrence period estimated 1-10 years at Kratie)

→ **Flood damages increase**

**COMPARISON BETWEEN ESTIMATED FLOOD DAMAGES IN 2000 AND 2011 IN THE LOWER MEKONG BASIN**

<table>
<thead>
<tr>
<th>Country</th>
<th>2000 Flood</th>
<th>2011 Flood</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fatalities</td>
<td>Economic damage (US$ million)</td>
<td>Fatalities</td>
</tr>
<tr>
<td>Cambodia</td>
<td>350</td>
<td>157-161</td>
<td>250</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>15</td>
<td>30</td>
<td>42</td>
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<tr>
<td>Thailand</td>
<td>25</td>
<td>21</td>
<td>na</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>320</td>
<td>125</td>
<td>104</td>
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</table>
DEVELOPMENT TRENDS

Scenarios for Council Study

- ‘Early Development Scenario’ using estimates of physical/socio-economic condition as of 2007
- ‘Definite Future Scenario’ using a projected physical/socio-economic condition as of 2020
- ‘Planned Development Scenario’ using a projected physical/socio-economic condition as of 2040
MAJOR DEVELOPMENTS ANTICIPATED IN 2020
WITH POTENTIAL IMPACT ON FLOOD RISK

As thus far no additional information on floodplain development or flood protection works has been received from MCs for the period between 2014 and 2020, it is proposed that (in principle) the 2014 ISIS model will be used to represent the situation in 2020.

MAJOR DEVELOPMENTS ANTICIPATED IN 2040
WITH POTENTIAL IMPACT ON FLOOD RISK

- Expansion of Urban Centres
- Upgrading National Road Networks
- Ring Roads around Phnom Penh
- Expansion Industrial Areas in Cambodia
- Conveyance Corridors
- Irrigation Schemes
- Move towards intensive agriculture with flood protection

- The draft development plans for 2060 formulated as part of Task 3 of the FMMP Initial Studies project will be used for formulating a 2040 scenario.
MAJOR DEVELOPMENTS IN 2040 IN THE CAMBODIAN FLOODPLAINS

ANTICIPATED IMPACTS OF DEVELOPMENTS
### 6 Cases to Explore Increase of Water Levels Due to Loss of Storage Area in the Cambodian Floodplain

**Cases**

<table>
<thead>
<tr>
<th>Cases</th>
<th>Urbanisation</th>
<th>Urbanisation + 50% loss on left bank (LB)</th>
<th>Urbanisation + 50% loss on LB and RB</th>
<th>Urbanisation + 50% loss of all floodplain</th>
<th>Urbanisation + 75% loss of storage</th>
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<tbody>
<tr>
<td>Test Case Number</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Kratie</td>
<td>0.01</td>
<td>0.01</td>
<td>0.14</td>
<td>0.14</td>
<td>0.16</td>
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<tr>
<td>Kampong Cham</td>
<td>0.08</td>
<td>0.08</td>
<td>0.86</td>
<td>0.88</td>
<td>0.96</td>
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<tr>
<td>Phnom Penh Port</td>
<td>0.17</td>
<td>0.16</td>
<td>0.35</td>
<td>0.39</td>
<td>0.46</td>
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<tr>
<td>Prek Kdam</td>
<td>0.09</td>
<td>0.08</td>
<td>0.18</td>
<td>0.22</td>
<td>0.28</td>
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<tr>
<td>Kampong Luong</td>
<td>0.13</td>
<td>0.12</td>
<td>0.18</td>
<td>0.22</td>
<td>0.28</td>
</tr>
<tr>
<td>Neak Luong</td>
<td>0.06</td>
<td>0.06</td>
<td>0.18</td>
<td>0.23</td>
<td>0.29</td>
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<tr>
<td>Koh Khel</td>
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<td>0.44</td>
<td>0.57</td>
<td>1.06</td>
<td>1.05</td>
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<tr>
<td>Tan Chau</td>
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<td>0.04</td>
<td>0.07</td>
<td>0.13</td>
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<tr>
<td>Chau Doc</td>
<td>-0.18</td>
<td>-0.18</td>
<td>-0.12</td>
<td>-0.20</td>
<td>-0.22</td>
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[www.mrcmekong.org](http://www.mrcmekong.org)
RESULTS INITIAL STUDIES

IMPACT ON MAXIMUM ANNUAL FLOW AT KRATIE AS A RESULT OF CLIMATE CHANGE (FOR ARI 2 AND 100)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Station Name</th>
<th>Annual peak flow frequency</th>
<th>Changes from Baseline</th>
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<tr>
<td>C9</td>
<td>Kratie</td>
<td>2</td>
<td>45586</td>
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<tr>
<td></td>
<td></td>
<td>100</td>
<td>67851</td>
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<tr>
<td>C9</td>
<td>Kampong Cham</td>
<td>2</td>
<td>41458</td>
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<td></td>
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<td>100</td>
<td>58583</td>
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<tr>
<td>C2</td>
<td>Phnom Penh-Chey</td>
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<td>Changvar</td>
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<td>C4</td>
<td>Phnom Penh-Chaktomuk</td>
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<td>4735</td>
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<td>100</td>
<td>58583</td>
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<tr>
<td>C2</td>
<td>Prek Kamlong (reversal flow)</td>
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<td>7912</td>
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<td>12238</td>
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<td>C4</td>
<td>Neak Leung</td>
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<tr>
<td>C3</td>
<td>Koh Kheil</td>
<td>2</td>
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<td>Chau Doc</td>
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<td>100</td>
<td>28344</td>
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<tr>
<td>V2</td>
<td>Tan Chau</td>
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<td>4193</td>
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<tr>
<td></td>
<td></td>
<td>100</td>
<td>6931</td>
</tr>
</tbody>
</table>

RESULTS INITIAL STUDIES

Flood Risk (2060) as a result of (moderate) climate change and sea level rise may increase considerably
INITIAL FINDINGS AND RECOMMENDATIONS

1. There is a need for integrated flood risk management to reduce flood damages

2. There is a need to formulate strategic directions
   - upstream of Kratie
   - downstream of Kratie

STRATEGIC DIRECTIONS
Flood damages 2011
Flood damages 2000

1. Upstream developments
2. Floodplain developments
3. Climate change

Situation 2040

Upstream developments
- Loss of storage area
- Squeezed conveyance
- Water levels go only up!!!

Flood damage 2040
Flood damage 2011

1. Maintain and improve storage TLS
2. Maintain and improve inflows / outflows TLS → Mekong River → East Sea
3. Reserve storage reservoirs / dams for flood mitigation

2. Floodplain developments
- Loss of storage area
- Squeezed conveyance
- Water levels go only up!!!
1. Upstream developments

1. Maintain and improve storage TLS

2. Maintain and improve in-/outflows TLS → Mekong River → East Sea

3. Reserve 20% storage reservoirs/dams for flood mitigation
   20% = 22,000 MCM
   TLS = 71,000 MCM

Inflow at Kratie from T=100 to T=2 years

Flood damage 2040
Flood damage 2011

3. Climate change

2. Floodplain developments

1. Secure river conveyance zones with land-use, zoning + (strong) legal framework

2. Provide flood protection around urban/residential areas

3. Find/develop other flood damage risk reduction measures

Flood damage 2040
Flood damage 2011

3. Reserve 20% storage reservoirs/dams for flood mitigation not or only marginally possible
Increase of flood frequency and flood severity:
more frequent flooding
“old” T = 10 ➔ “new” T = 2 yrs
more severe flooding:
“new” T = 10 gives much higher discharge than “old” T = 10 yrs

SUMMARIZING STRATEGIC DIRECTIONS

1. Protect Tonle Sap Lake; maintain or increase existing storage volume

2. Protect conveyance channels / flood storage areas

3. Land use planning (including “strong” legal framework) for protecting conveyance channels / flood storage areas and flood risk reduction in floodplains

4. Create retention volume at dam-reservoirs upstream Kratie
NEXT STEPS

1. Scenarios to be completed with results of other thematic teams
2. Simulation runs by IKMP of the various scenarios
3. Assess the impact of thematic development scenarios on flood risk
4. Develop strategic directions for flood risk reduction
The RTWG is requested to:

- Take note of progress

- Consider the proposed next steps to develop strategic directions for integrated flood risk reduction

- Provide overall feedback and guidance at this time when necessary

Thank You