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For sustainable development



Council Study

Interim Thematic Assessment for Flood Protection & Floodplain Infrastructure

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

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Contents

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

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Current developments

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Driving forces behind a larger future flood risk:

1. Floodplain developments

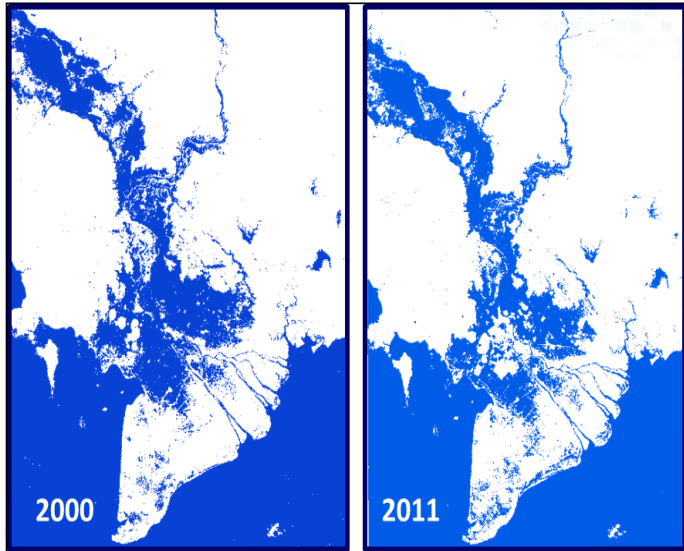
higher investment level, increase in population, change in economic activities, more built up area, high quality living area, loss of retention/storage volume for flooding

2. Climate Change

larger maximum flows in flood season, sea level rise, resulting in higher flood levels, longer duration and larger extent

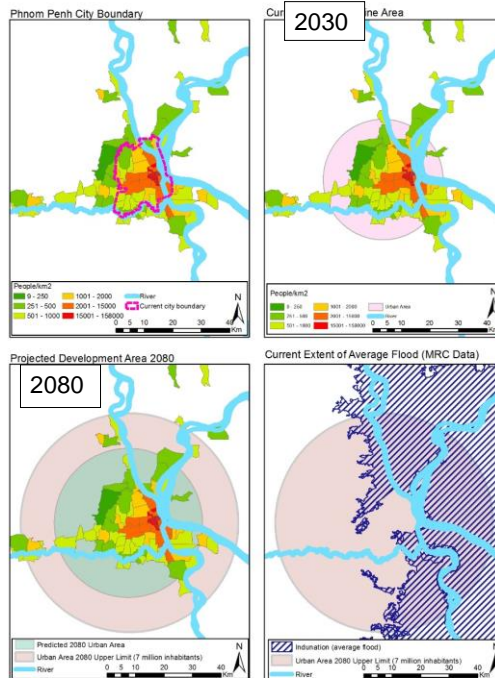
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Ongoing loss of retention / storage volume in Cambodian floodplain / Mekong delta



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Potential urban encroachment onto Cambodian floodplain



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



Country	2000 Flood		2011 Flood	
	Fatalities	Economic damage (US\$ million)	Fatalities	Economic damage (US\$ million)
Cambodia	350	157-161	250	634
Lao PDR	15	30	42	208
Thailand	25	21	na	na
Viet Nam	320	125	104	260



DEVELOPMENT TRENDS

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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**

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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.

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MAJOR DEVELOPMENTS ANTICIPATED IN 2040 WITH POTENTIAL IMPACT ON FLOOD RISK

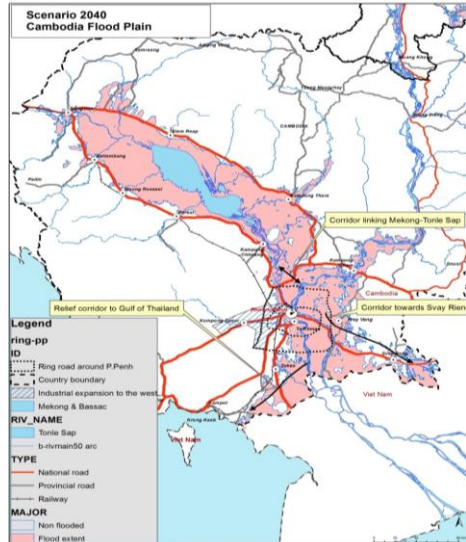


- *Expansion of Urban Centres*
- *Upgrading National Road Networks*
- *Ring Roads around Phnom Penh*
- *Expansion Industrial Areas in Cambodia*
- *Conveyance Corridors*
- *Irrigation Schemes*
- *Move towards intensive agriculture with flood protection*

- 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.

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MAJOR DEVELOPMENTS IN 2040 IN THE CAMBODIAN FLOODPLAINS



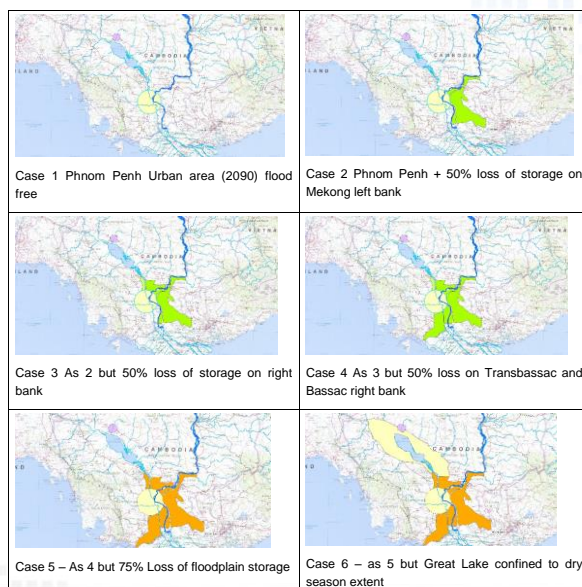
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ANTICIPATED IMPACTS OF DEVELOPMENTS



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6 CASES TO EXPLORE INCREASE OF WATER LEVELS DUE TO LOSS OF STORAGE AREA IN THE CAMBODIAN FLOODPLAIN



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6 CASES TO EXPLORE INCREASE OF WATERLEVELS DUE TO LOSS OF STORAGE AREA IN THE CAMBODIAN FLOODPLAIN (BASED ON 2011 FLOOD)



Cases	Urbanisation	Urbanisation + 50% loss on left bank (LB)	Urbanisation + 50% loss on LB and RB	Urbanisation + 50% loss of all floodplain	Urbanisation + 75% loss of storage	Urbanisation, 75% loss of storage + Great Lake confined to Dry Season Area
Test Case Number	1	2	3	4	5	6
Kratie	0.01	0.01	0.14	0.14	0.16	0.19
Kampong Cham	0.08	0.08	0.86	0.88	0.96	1.12
Phnom Penh Port	0.17	0.16	0.35	0.39	0.46	1.45
Prek Kdam	0.09	0.08	0.18	0.22	0.28	1.41
Kampong Luong	0.13	0.12	0.18	0.22	0.28	1.43
Neak Luong	0.06	0.06	0.18	0.23	0.29	0.83
Koh Khel	0.45	0.44	0.57	1.06	1.05	1.60
Tan Chau	0.04	0.04	0.07	0.13	0.13	0.54
Chau Doc	-0.18	-0.18	-0.12	-0.20	-0.22	0.19

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RESULTS INITIAL STUDIES



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

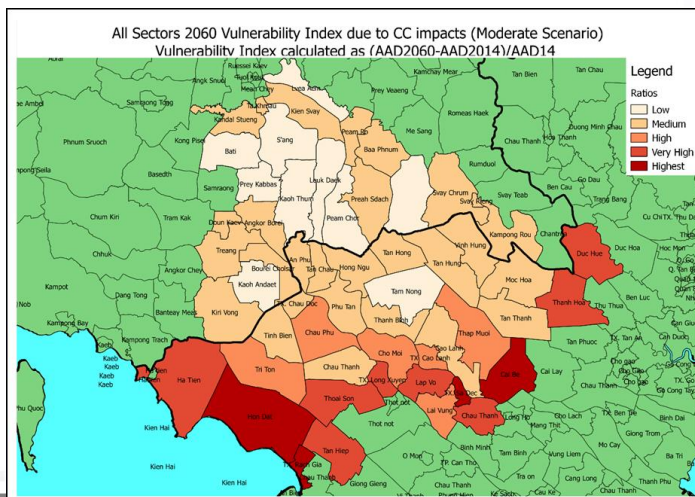
Zone	Station Name	ARI	Annual peak flow frequency							Changes from Baseline					
			BL 2014	CC-M 2030	CC-M 2060	CC-S 2060	CC-E 2060	CC-D 2060	CC-M 2090	CC-M 2030	CC-M 2060	CC-S 2060	CC-E 2060	CC-D 2060	CC-M 2090
			2	45598	46756	48016	55375	62958	38651	52649	1.025	1.053	1.214	1.381	0.848
100	67851	72277	77157	85264	101491	75429	81018	1.065	1.137	1.257	1.496	1.112	1.194		
C9	Kratie	2	41458	41840	42864	49905	56287	35766	46326	1.009	1.034	1.204	1.358	0.863	1.117
		100	58583	63360	68334	74572	88632	64499	71982	1.082	1.166	1.273	1.513	1.101	1.229
C9	Kampong Cham	2	34981	35352	35962	38623	40090	32154	37302	1.011	1.028	1.104	1.146	0.919	1.066
		100	42468	43470	44075	43927	48153	43671	44285	1.024	1.038	1.034	1.134	1.028	1.043
C2	Phnom Penh Chroy Changvar	2	4735	4803	5027	5442	5913	4063	5336	1.014	1.062	1.149	1.249	0.858	1.127
		100	5883	6038	6127	6849	7637	5750	6378	1.026	1.041	1.164	1.298	0.977	1.084
C4	Phnom Penh Chaktomuk	2	-7912	-8210	-8520	-9059	-9751	-7313	-8740	1.038	1.077	1.145	1.232	0.924	1.105
		100	-12238	-12467	-12131	-12681	-12992	-12728	-12731	1.019	0.991	1.036	1.062	1.040	1.040
C2	Prek Kdam (reversal flow)	2	26300	26537	27667	30859	34024	22974	29805	1.009	1.052	1.173	1.294	0.874	1.133
		100	34758	36081	37010	40130	43741	31830	38234	1.038	1.065	1.155	1.258	0.916	1.100
C4	Neak Leung	2	3498	3515	3641	3917	4158	3059	3857	1.005	1.041	1.120	1.189	0.874	1.102
		100	4193	4299	4310	4570	5035	4155	4453	1.025	1.028	1.090	1.201	0.991	1.062
C3	Koh Khel	2	5614	5778	6125	6502	7334	4605	6141	1.029	1.091	1.158	1.306	0.820	1.094
		100	8935	9066	10517	9233	10974	7042	9453	1.015	1.177	1.033	1.228	0.788	1.058
C1	Kampong Luong	2	5300	5357	5543	6228	6954	4499	6008	1.011	1.046	1.175	1.312	0.849	1.134
		100	6931	7050	7321	8543	10323	6267	7871	1.017	1.056	1.233	1.489	0.904	1.136
V1	Chau Doc	2	22856	22980	23771	25728	27292	20365	25117	1.005	1.040	1.126	1.194	0.891	1.099
		100	28344	29049	29065	29567	29694	26408	29104	1.025	1.025	1.043	1.048	0.932	1.027

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RESULTS INITIAL STUDIES



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



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INITIAL FINDINGS AND RECOMMENDATIONS

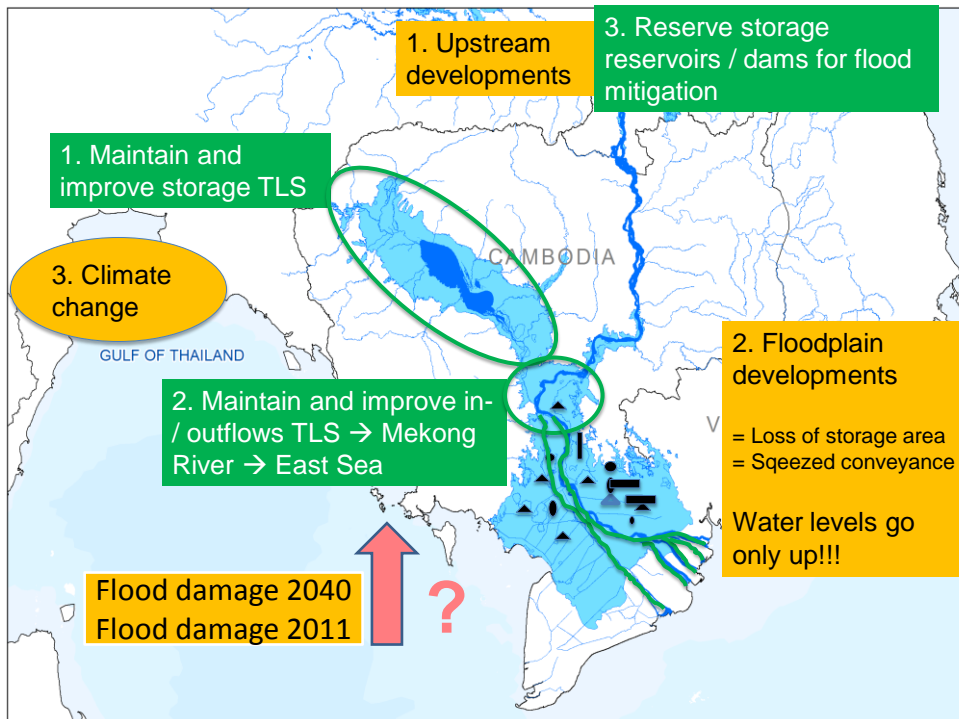
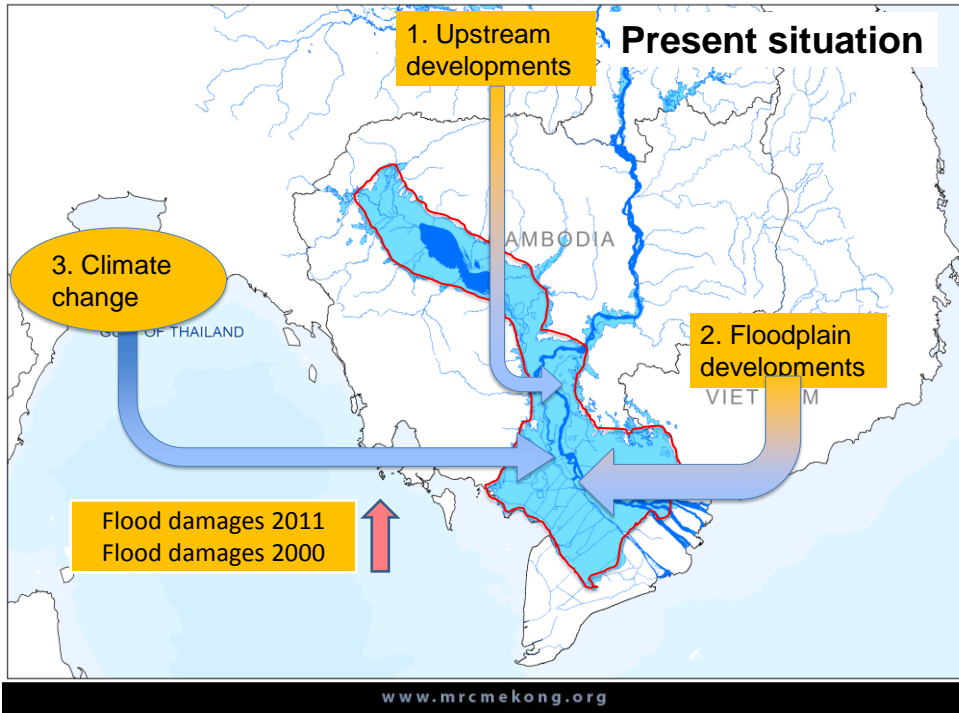


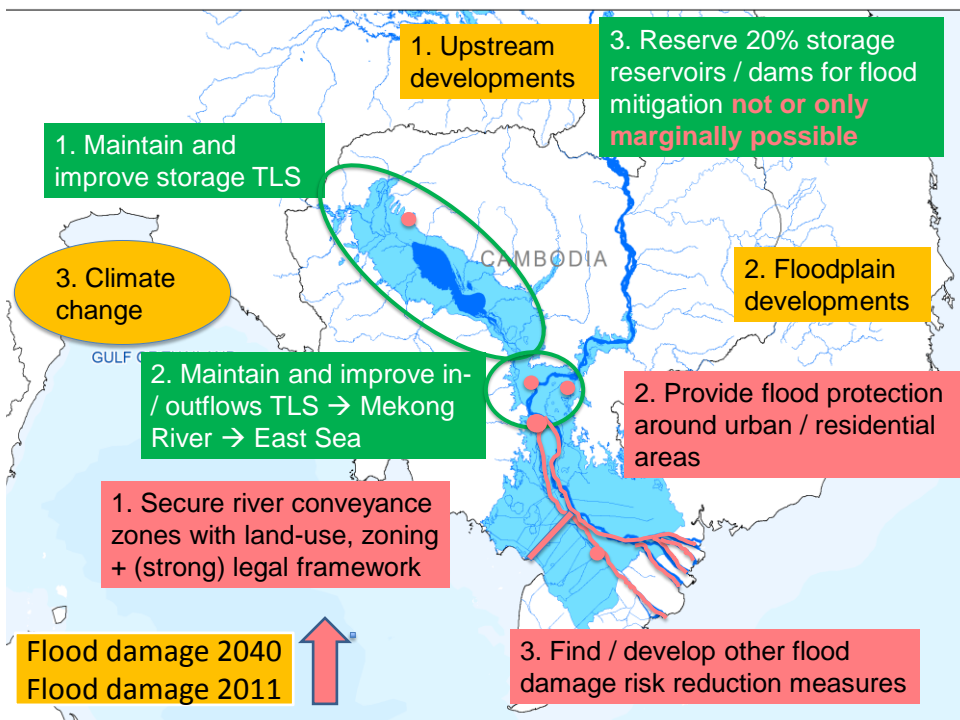
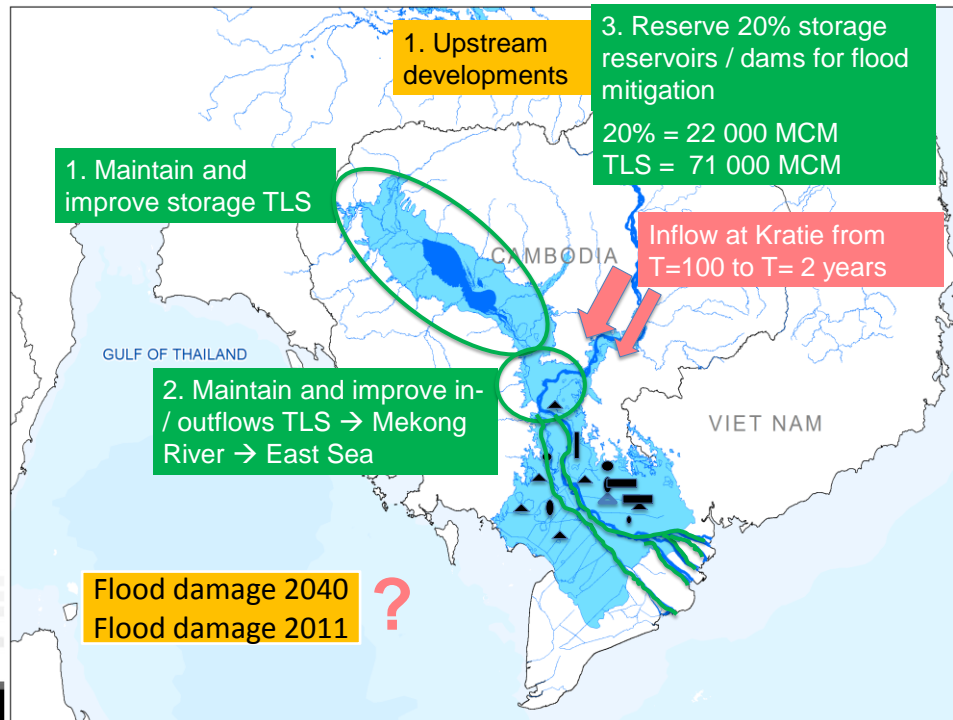
- 1. There is a need for integrated flood risk management to reduce flood damages**
- 2. There is a need to formulate strategic directions**
 - upstream of Kratie
 - downstream of Kratie

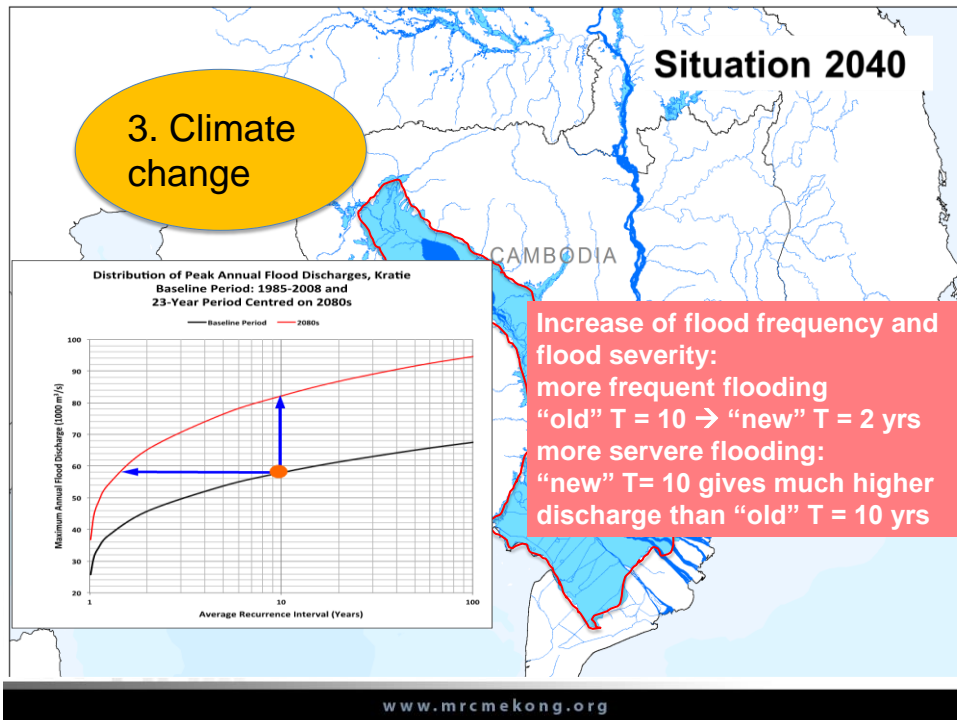
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STRATEGIC DIRECTIONS

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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

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- 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**

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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

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Thank You

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