New JICA's Initiative on Climate Change Adaptation in Water Related Disasters

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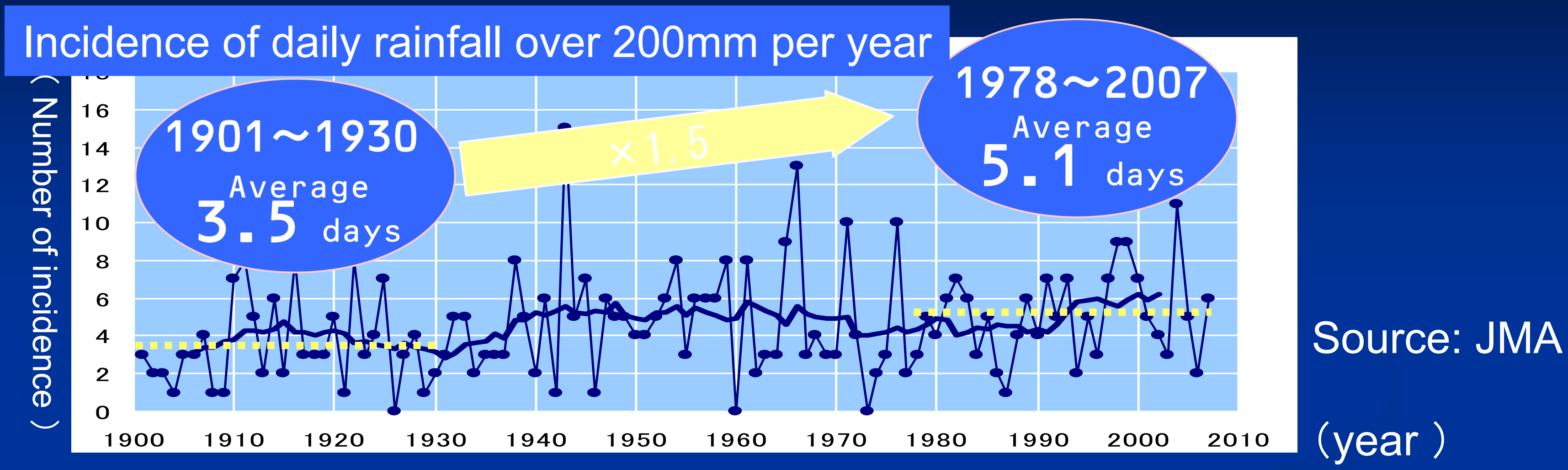
outline

1. Situation in Japan
2. Staitionarity is dead
3. JICA's new initiative
4. Case study

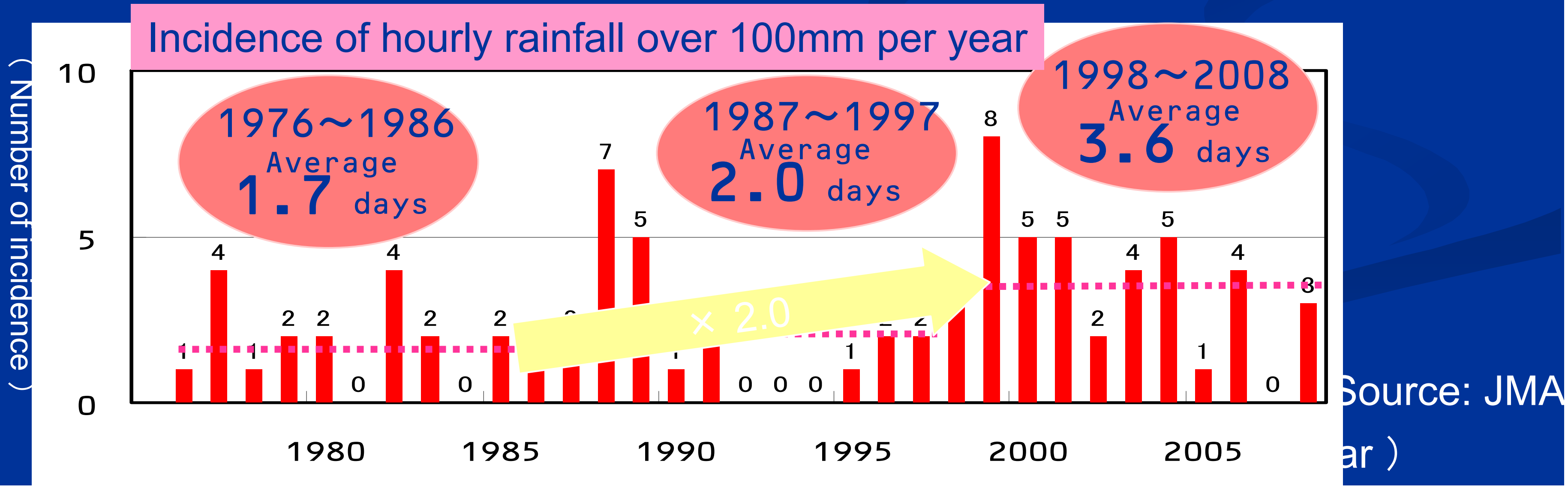
   - Tagaloan River Basin in the Philippines -

Recent change on Climate in Japan

Daily rainfall over 200mm is significantly increasing



Hourly rainfall over 100mm is increasing



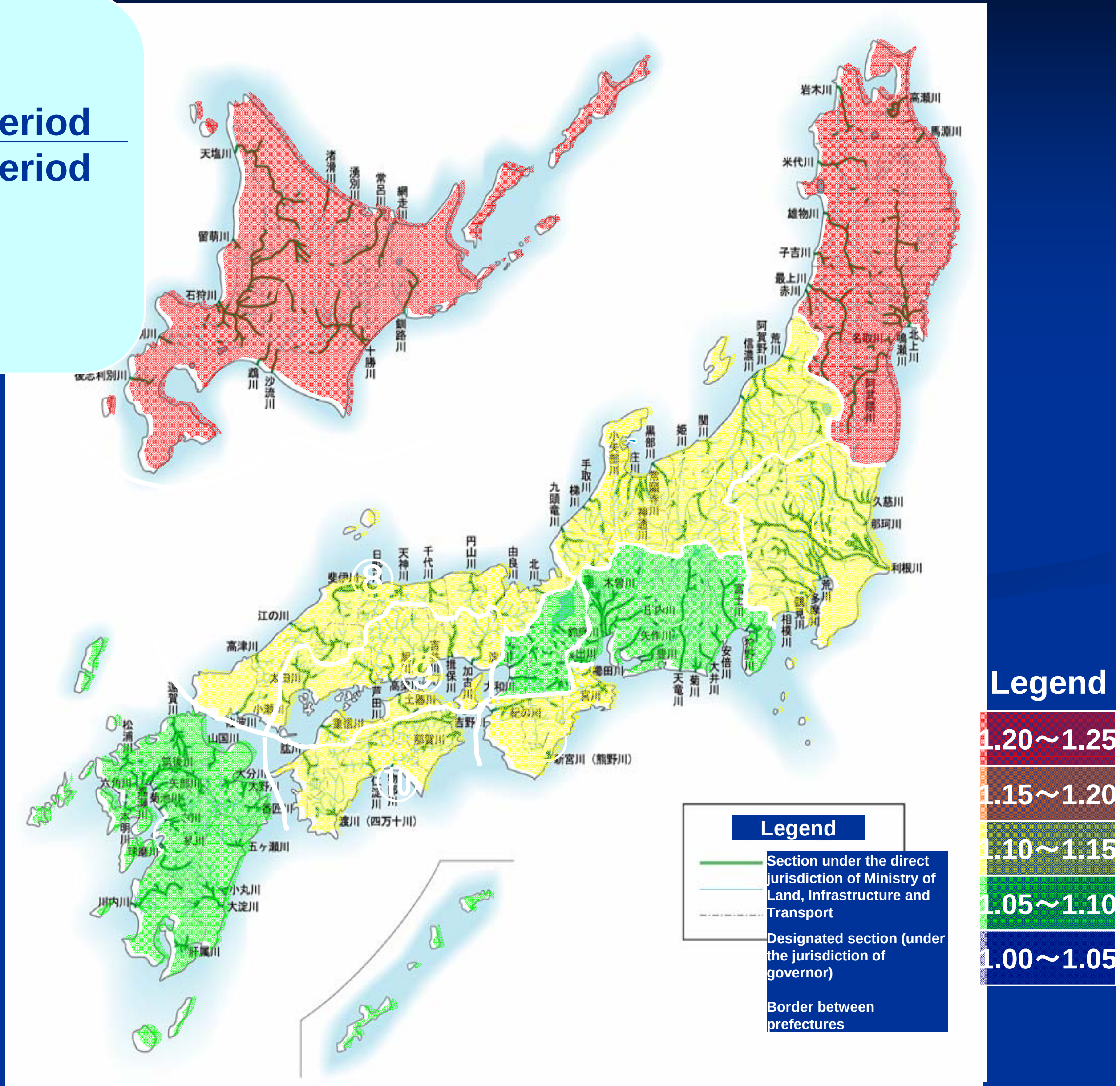
Areas with increased rainfall amount

Future rainfall amounts predicted

$$\frac{\text{Average rainfall in 2080-2099 period}}{\text{Average rainfall in 1979-1998 period}}$$

maximum daily precipitation
GCM20 (A1B scenario)

①	Hokkaido	1.24
②	Tohoku	1.22
③	Kanto	1.11
④	Hokuriku	1.14
⑤	Chubu	1.06
⑥	Kinki	1.07
⑦	Southern Kii	1.13
⑧	San-in	1.11
⑨	Setouchi	1.10
⑩	Southern Shikoku	1.11
⑪	Kyushu	1.07



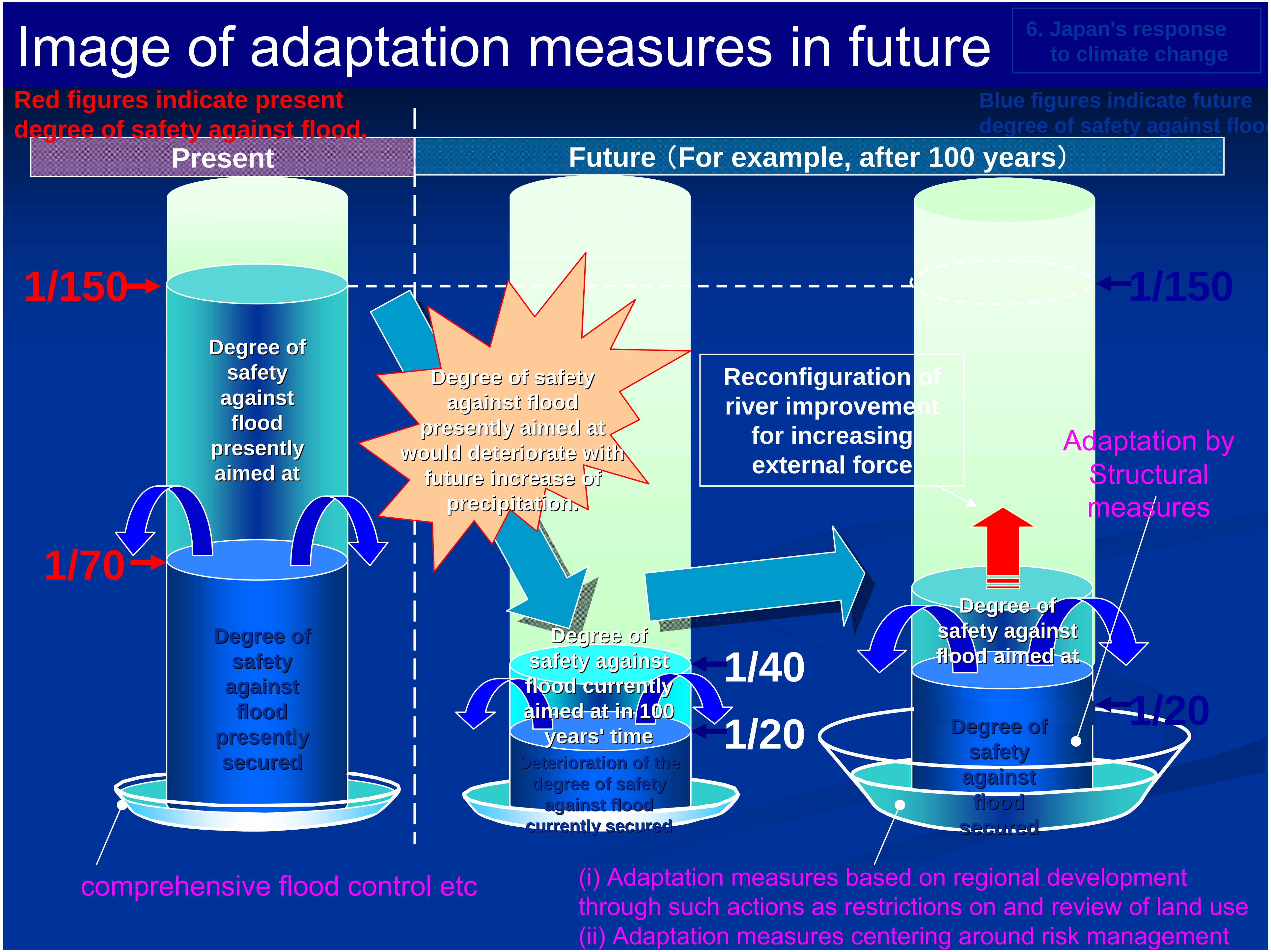


Image of adaptation measures in future
6. Japan's response to climate change
Red figures indicate present degree of safety against flood.
Blue figures indicate future degree of safety against flood
Present
Future（For example, after 100 years）
1/150
1/70
Degree of safety against flood presently aimed at
Degree of safety against flood presently secured
Degree of safety against flood presently aimed at would deteriorate with future increase of precipitation.
Reconfiguration of river improvement for increasing external force
1/150
Adaptation by Structural measures
Degree of safety against flood currently aimed at in 100 years' time
Deterioration of the degree of safety against flood currently secured
1/40
1/20
Degree of safety against flood aimed at
Degree of safety against flood secured
1/20
comprehensive flood control etc
(i) Adaptation measures based on regional development through such actions as restrictions on and review of land use
(ii) Adaptation measures centering around risk management

2. Stationarity is dead

2. Stationarity is Dead[1)]
we are in trouble

☺ Conventional Method of Water Planning

Assumption: fluctuate within an unchanging envelope of variability

☹ Under changing and uncertain climate

✓ Climate is changing

Return period (ex. 100 years flood or 10 years drought) is never foundation of planning

✓ Prediction possible, but with uncertainty

Designing methods of water infrastructures are needed

River bank heights, dam reserve capacity, bridge heights etc.

1) Milly P. C. D., J. Betancourt, M. Falkenmark, R. M. Hirsch, Z. W. Kundzewics, D. P. Lettenmaier, R. J. Stouffer (2008), Stationarity is Dead: Whither Water Management, *Science*. 319, p. 573-574.

Furthermore……

2. Stationarity is Dead

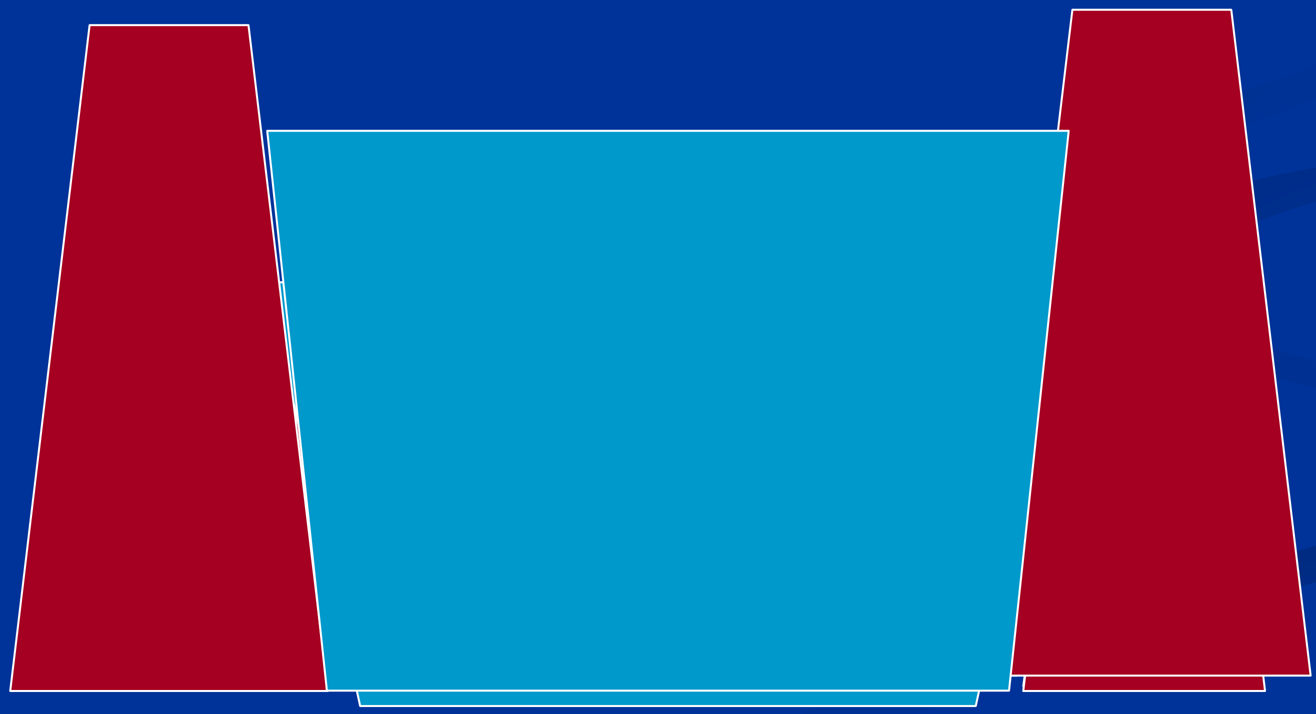
Society to sustainably response changes

1. to respond continuously changing climate
2. to plan and implement infrastructure projects through predicting future impacts with uncertainty
3. to change systems of water management according to developing technology for prediction and adaptation of climate change

2. Stationarity is Dead

Is flood Control Philosophy Dead, also?

- Can we continue to construct higher dykes according to increasing flood scale?



2. Stationarity is Dead

Flood Control Philosophy is Dead as Well.

- Conventional philosophy is abandoned.

  "Long liner bank system along river from river mouth to mountain"
- Proposed philosophy

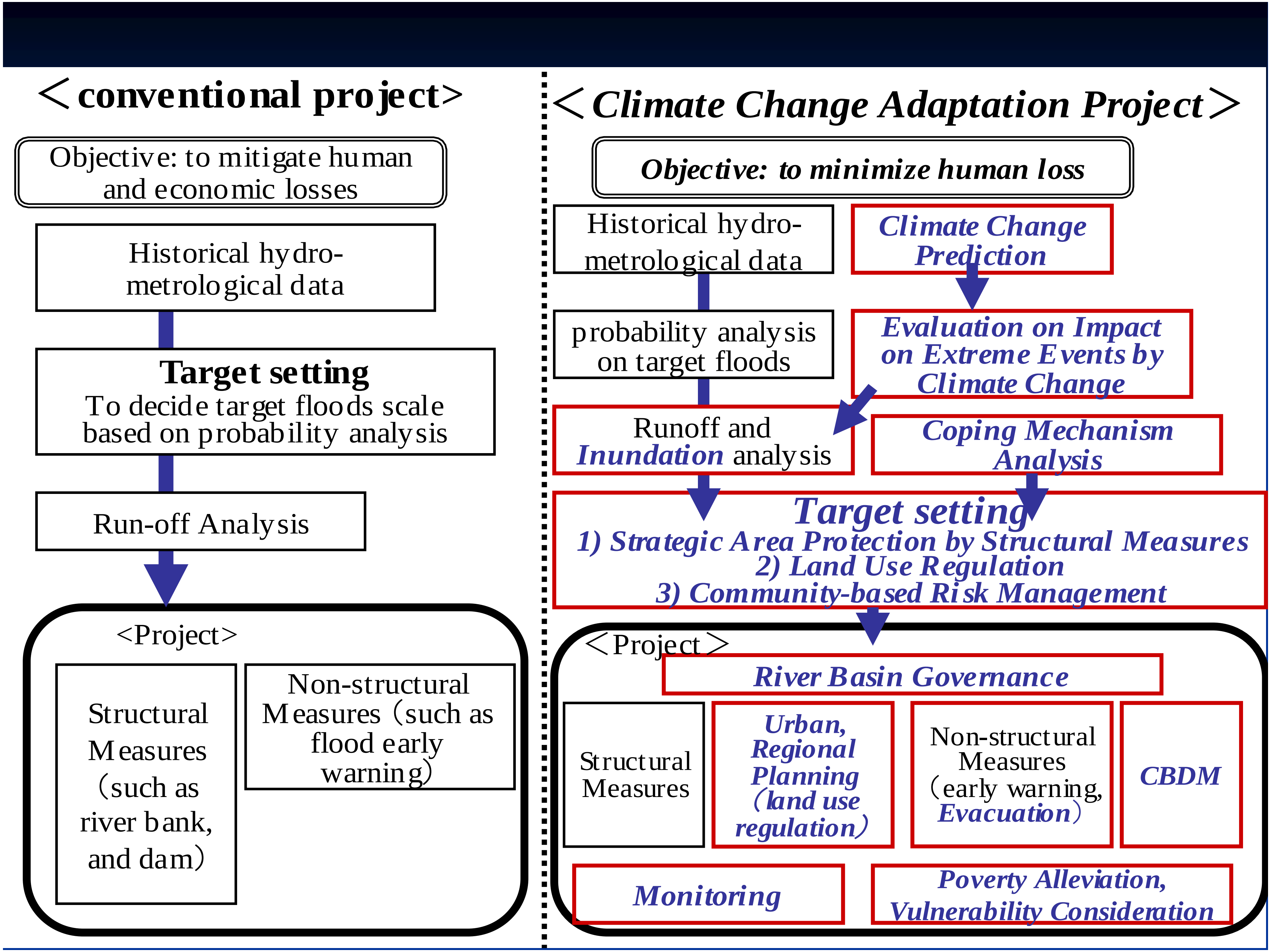
  "Multi-layered measures in river basin"

  1) Step 1: Strategic area protect by structures

  2) Step 2: Urban planning and land use regulation for risk areas

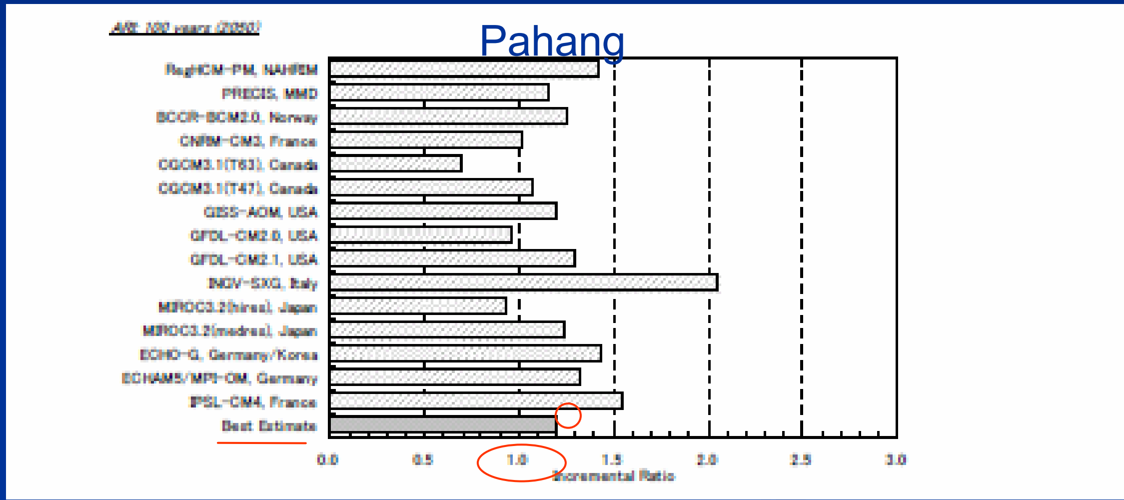
  3) Step 3: CBDM

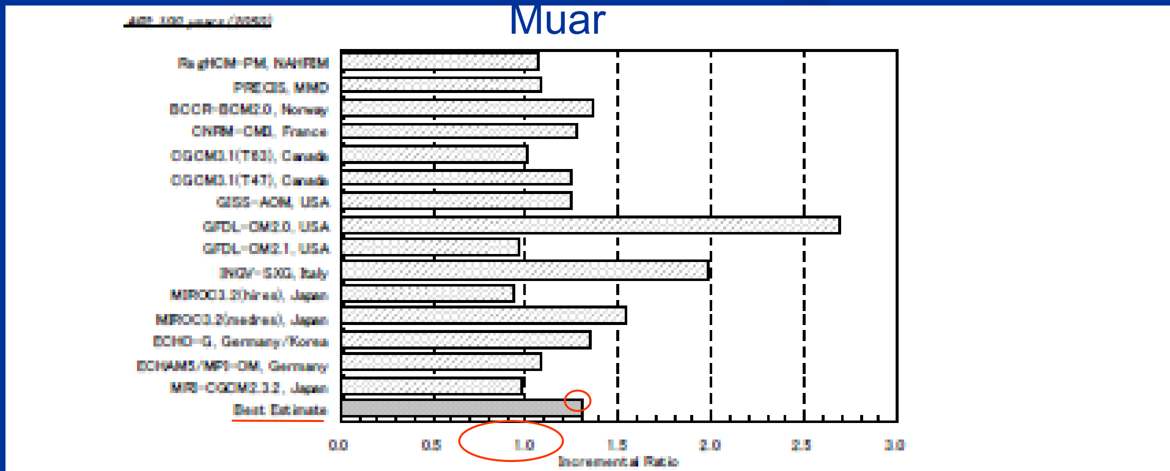
3. JICA's new initiative



＜conventional project>
Objective: to mitigate human and economic losses
Historical hydro-metrological data
Target setting
To decide target floods scale based on probability analysis
Run-off Analysis
<Project>
Structural Measures（such as river bank, and dam）
Non-structural Measures（such as flood early warning）
＜Climate Change Adaptation Project＞
Objective: to minimize human loss
Historical hydro-metrological data
Climate Change Prediction
probability analysis on target floods
Evaluation on Impact on Extreme Events by Climate Change
Runoff and Inundation analysis
Coping Mechanism Analysis
Target setting
1) Strategic Area Protection by Structural Measures
2) Land Use Regulation
3) Community-based Risk Management
＜Project＞
River Basin Governance
Structural Measures
Urban, Regional Planning（land use regulation）
Non-structural Measures（early warning, Evacuation）
CBDM
Monitoring
Poverty Alleviation, Vulnerability Consideration

Climate change perdition ensemble of GCM





Incremental ration of RegHCM-PM was obtained by relative ratio of the 1984-1993 result and 2041-2050 results

Climate change perdition

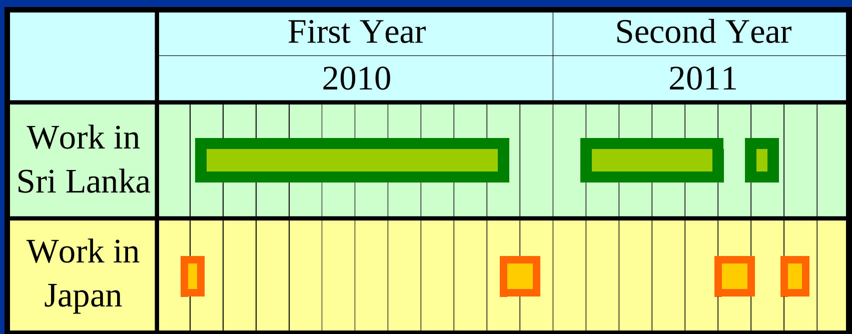
Study in South Western Sri Lanka

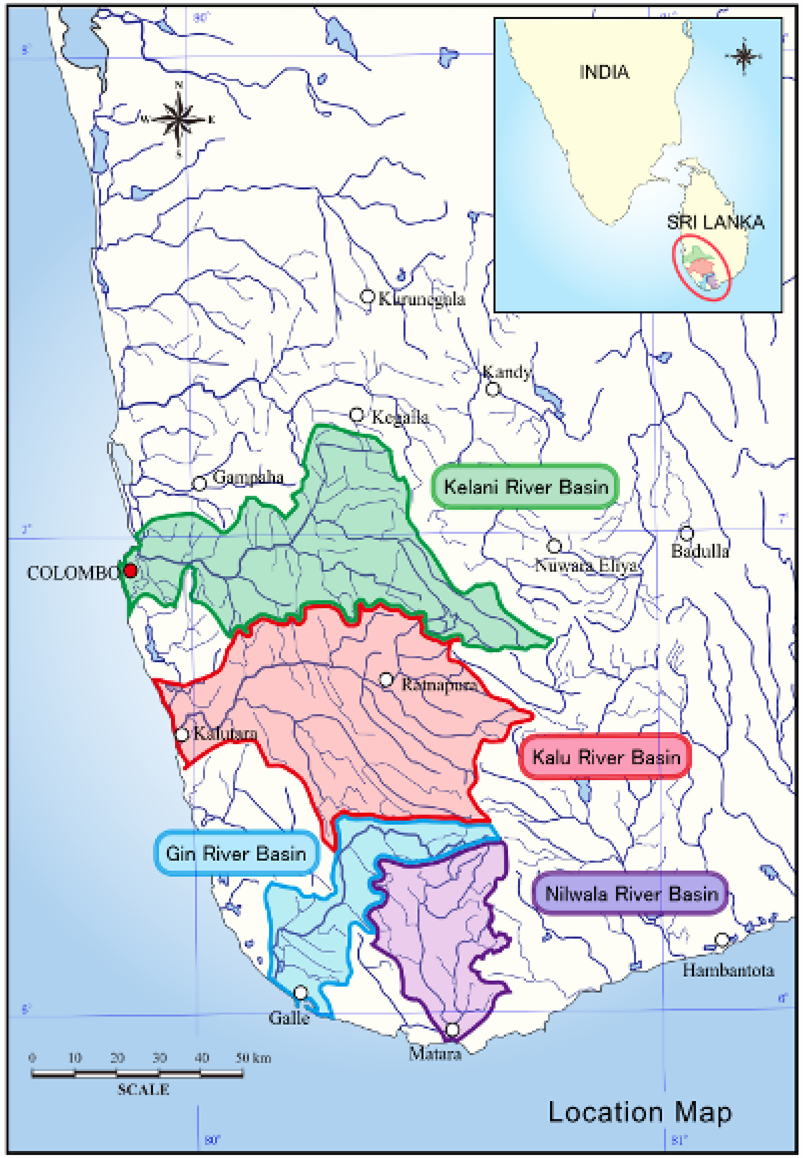
Study Area

River Basin	C.A.
Kalu River basin	$2{,}719 km^2$
Kelani River basin	$2{,}292 km^2$
Gin River basin	$932 km^2$
Nilwara River basin	$971 km^2$

Study Schedule

21 months
(from January 2010 to September 2011)





Climate change perdition

Study in South Western Sri Lanka

(1) Data Collection

- Projected Rainfall Data from CMIP3
- Projected Rainfall Data of GCM20 (1979-1998, 2080-2099)
- Recorded Rainfall Data in Project Area
- Mesh Rainfall data from APHRODITE daily precipitation

↓

(2) Examination of Appropriateness of **GCM20** by Comparison with CMIP3 Rainfall Data

↓

(3) **Bias Correction** and **Statistic Downscaling**

↓

(4) Evaluation of Flood Risk
(Hydrological and Hydraulic Analyses)

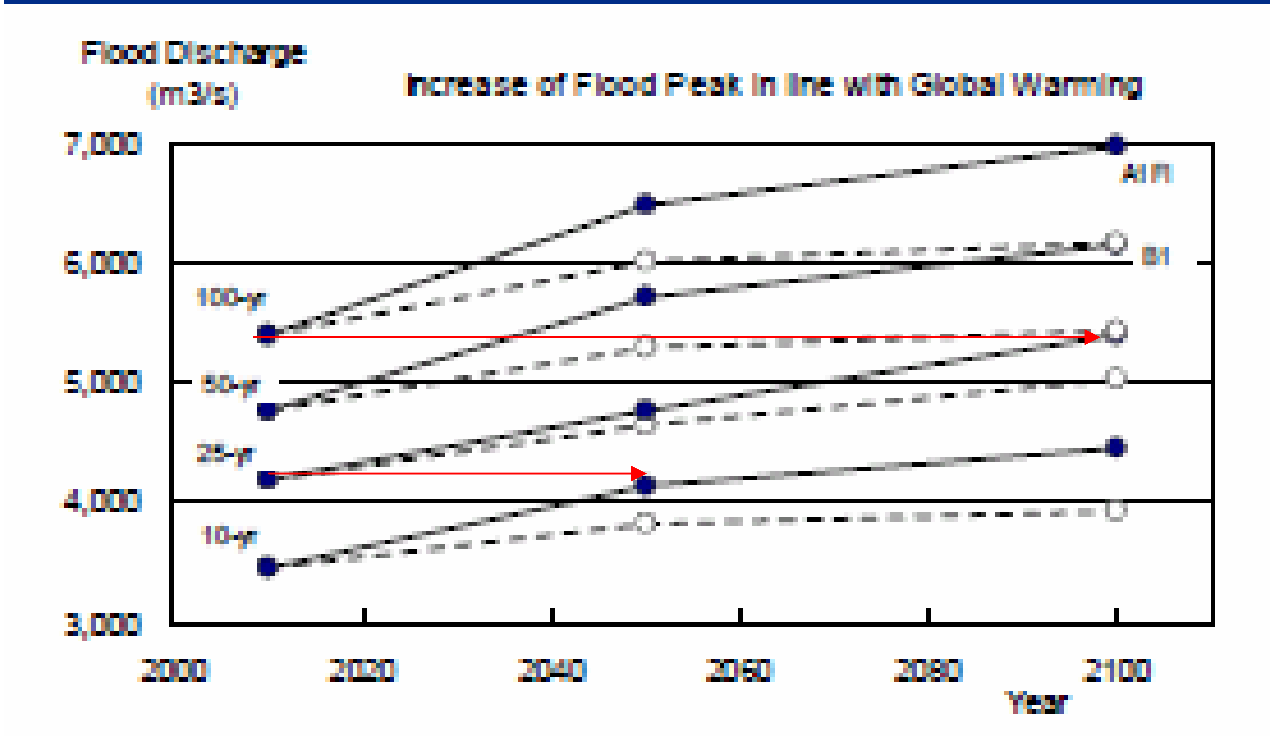
Note: CMIP3: Phase 3 of Coupled Model Intercomparison Project
GCM20: General Circulation Model (20km grid)
APHRODITE: Asian Precipitation-High Resolved Observational Data Integration Towards Evaluation of the Water Resources

Climate change adaptation measures

- Governance at river basin level
  - various sectors, organizations, stakeholders are involved
  - Need for consensus building and responsibility sharing
- Land use regulation
- Capacity Development

4. Case study

4-1 Tagaloan River Basin, the Philippines



100 yrs flood
→ 25-50yr flood in 2100

50 yrs flood
→ 25yr flood in 2050

Tagaloan River Basin, the Philippines

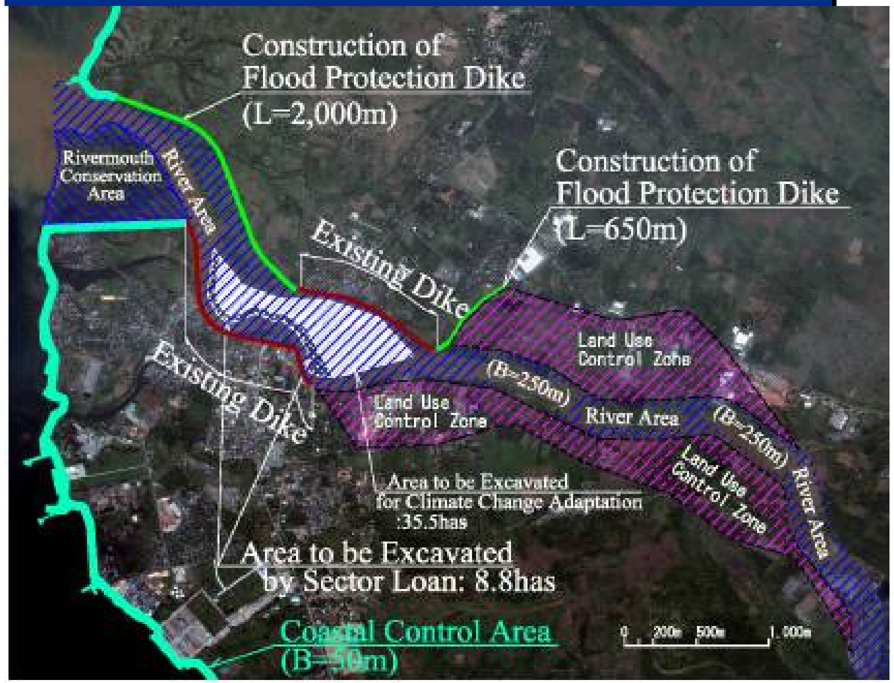
Scenario		Increase rate of rainfall intensity (%)	Return period (year)	Design rainfall (mm)					Probable Flood Discharge (m3/s)	
				5yr	10yr	25yr	50yr	100yr	25yr	50yr
Status quo		-		125	142	164	181	198	4190	4770
A1F1	2050	11		150	170	197	217	237	4780	5720
	2100	14		161	183	211	233	255	5400	6150
B1	2050	20		138	157	182	200	219	4650	5290
	2100	29		142	162	187	206	225	5030	5430

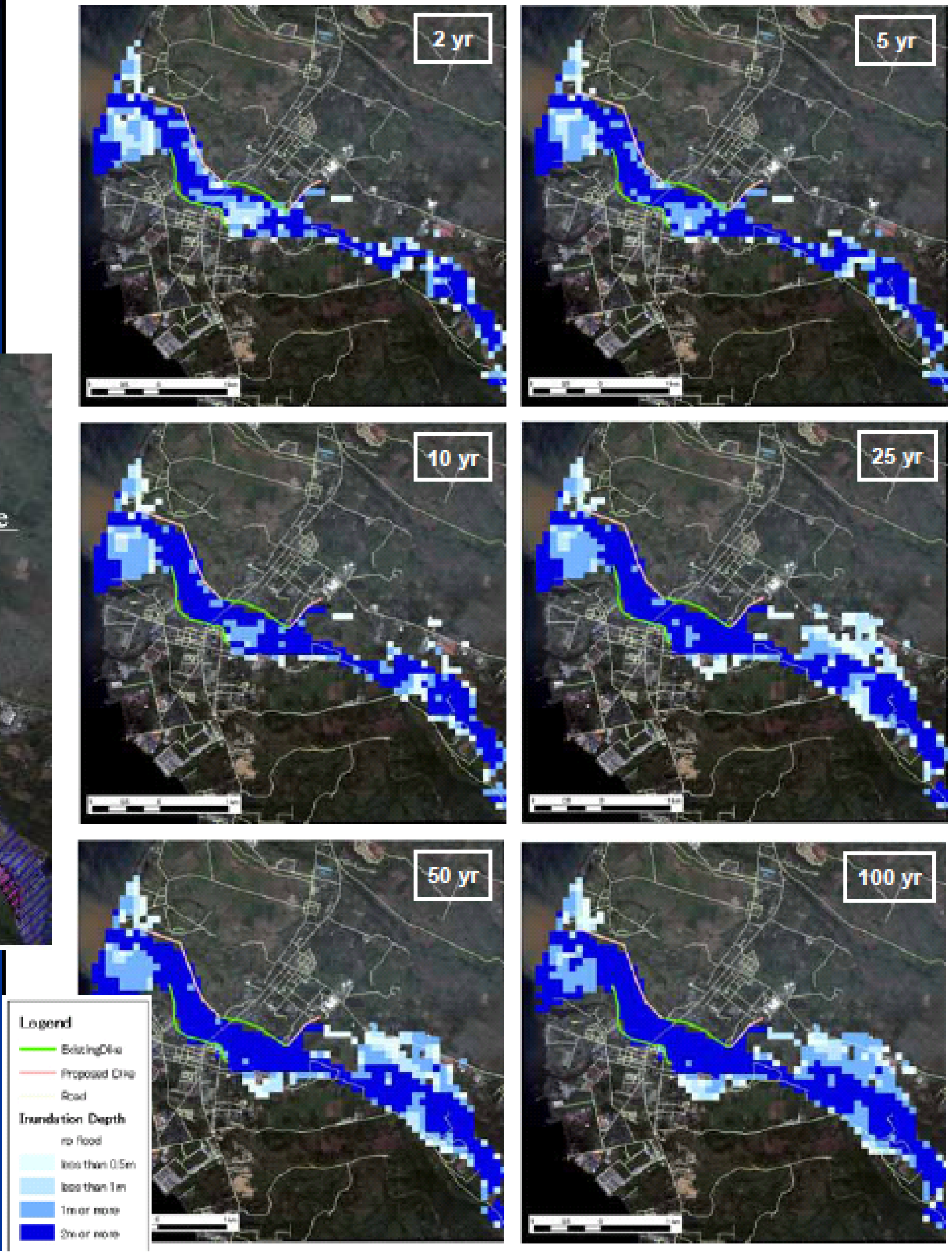
Tagaloan River Basin, the Philippines

Planning

Original MP

Revised MP


Construction of
Flood Protection Dike
(L=2,000m)
Rivermouth
Conservation
Area
River Area
Construction of
Flood Protection Dike
(L=650m)
Existing Dike
Land Use
Control Zone
(B=250m)
Existing Dike
Land Use
Control Zone
River Area
(B=250m)
Land Use
Control Zone
River Area
Area to be Excavated
for Climate Change Adaptation
:35.5has
Area to be Excavated
by Sector Loan: 8.8has
Coastal Control Area
(B=50m)


2 yr
5 yr
10 yr
25 yr
50 yr
100 yr
Legend
Road
Inundation Depth
1m or more

4-2. Metro Manila Suburb, Philippines : Cavite Area

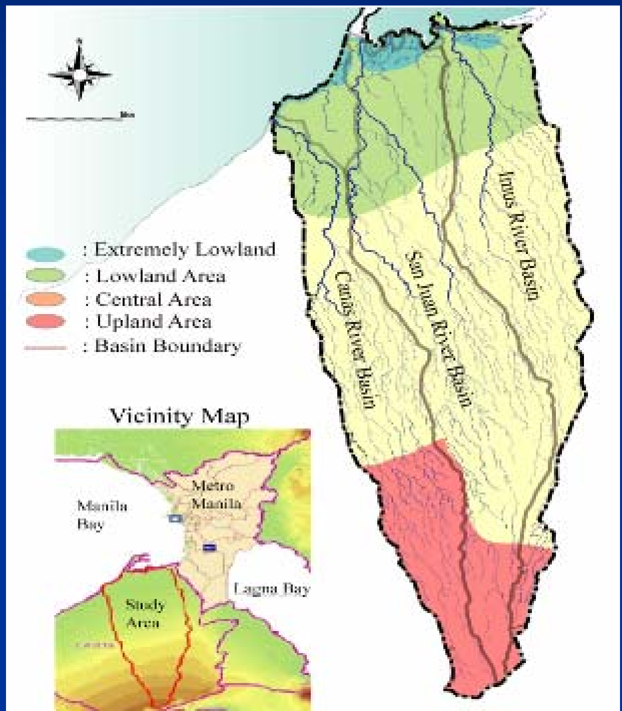
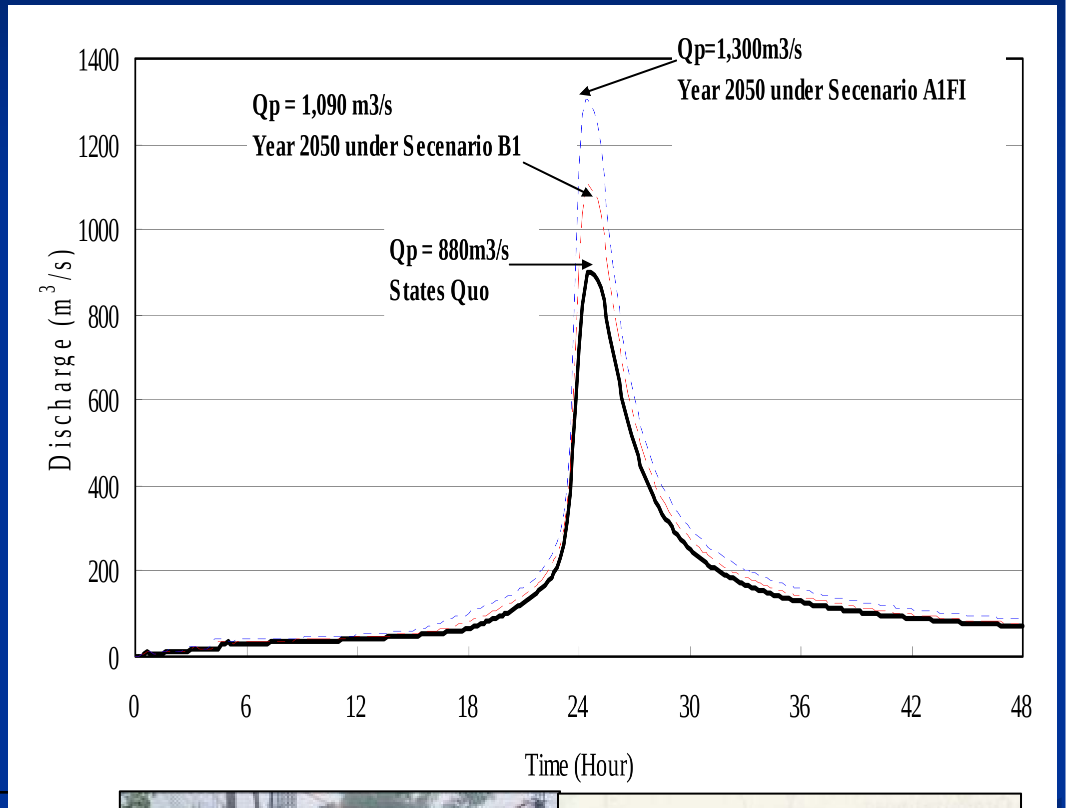
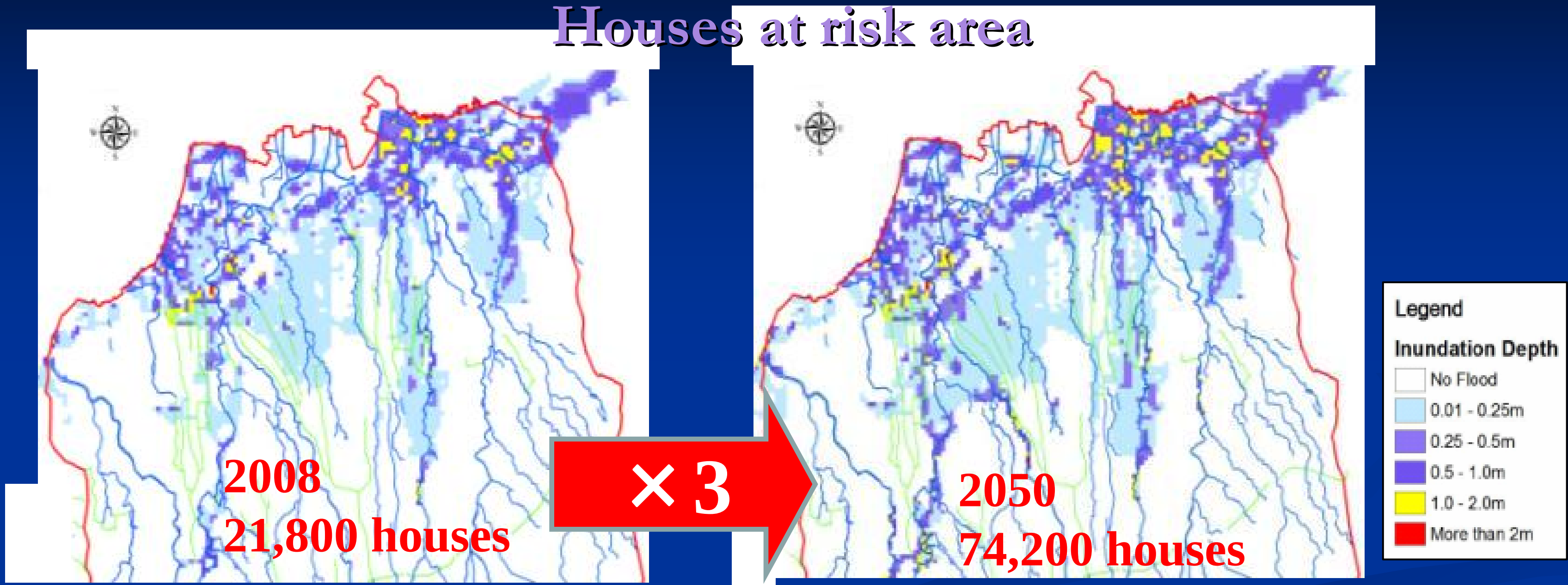


Fig. 1 General Map of Study Area



River Basin	Catchments Area (km2)	River Length (km)
Imus	115.5	45.0
San Juan	147.76	43.4
Canas	112.32	42.0
Residual	32.84	-
Total	407.4	

危険地域の家屋数
Houses at risk area



Case No.	Scenario of Climate Change	Urbanized Ratio	Probable Flood Inundation Area (km^2)			Number of Houses/Buildings Inundated (thousand houses)		
			Flood Depth below 1m	Flood Depth above 1m	Total	Flood Depth below 1m	Flood Depth above 1m	Total
1	Status Quo	26%*	31.51	1.05	32.56	20.1	1.7	21.8
2	States Quo	43%**	35.82	1.50	37.32	31.4	2.9	34.4
3	In 2050 under B1 Scenario		41.10	2.52	43.62	35.5	4.4	39.9
4	In 2050 under A1FI Scenario		44.64	3.54	48.18	38.4	5.9	44.3
5	States Quo	65%***	41.05	2.45	43.50	56.4	7.2	63.6
6	In 2050 under B1 Scenario		43.92	2.97	46.89	60.1	8.5	68.6
7	In 2050 under A1FI Scenario		47.27	3.98	51.25	63.0	11.2	74.2

Note:
*: The present urbanized ratio as of 2003
**: The urbanized ratio in 2020 proposed by the JICA Study Team
***: The urbanized ratio in 2020 projected by the local governments

3. multiplication of CC and Urbanization

都市化　Urbanization

気候変動
Climate Change

表面流
Surface flow ↗

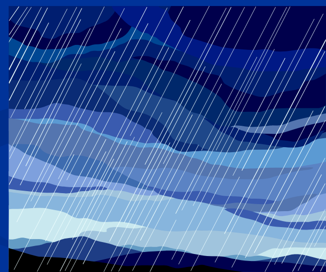
雨
Rain ↗

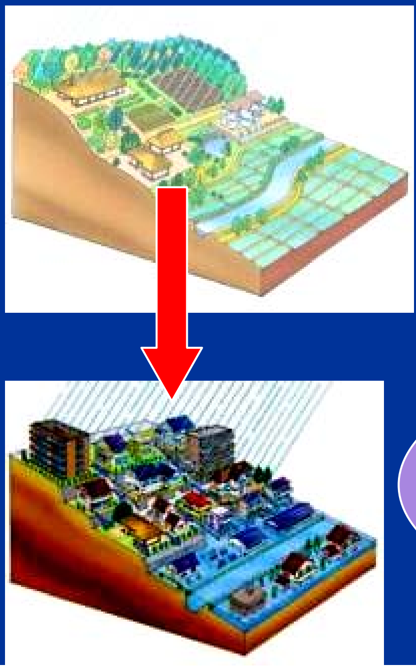
海面上昇
Sea Level ↗

危険地域の家屋
Houses at risk area ↗

洪水
Floods volume ↗

危険地域
Risk area ↗

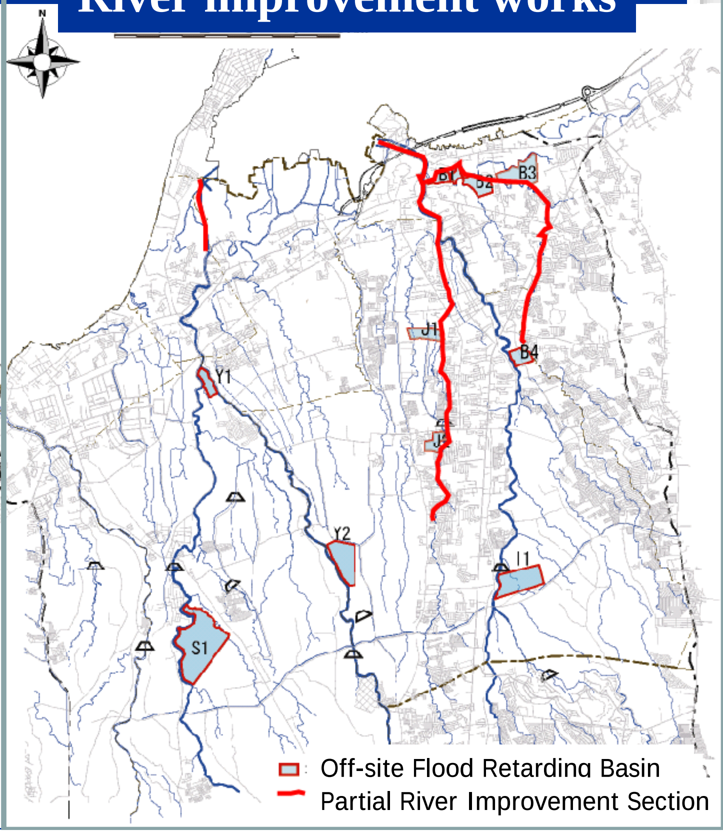


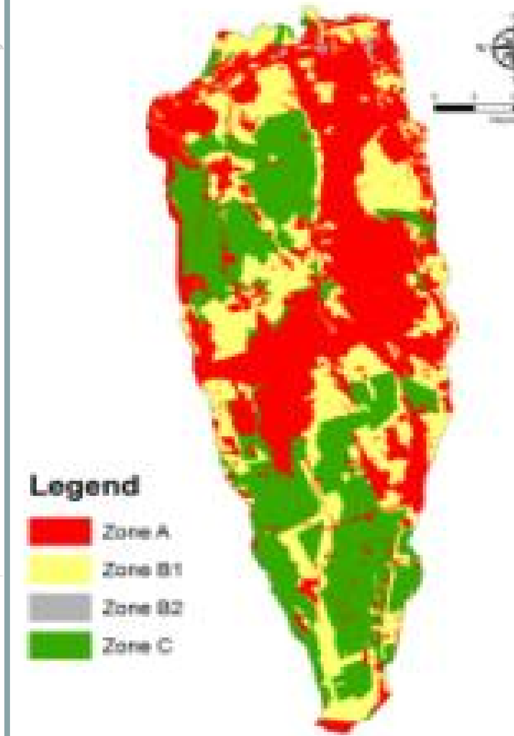


適応策検討　Climate Change Adaptation

遊水地計画を将来拡張する可能性
→都市計画に開発抑制地域として線引き

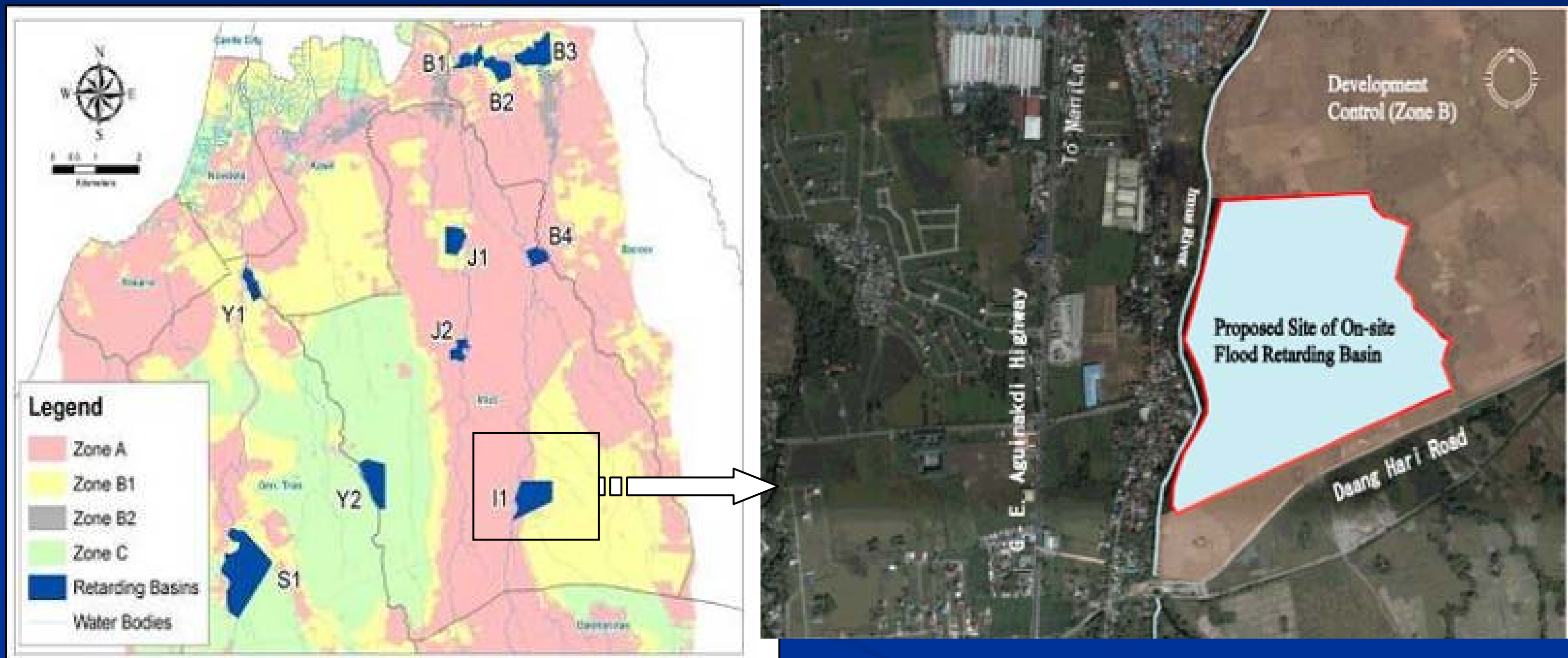
1. 河川工事・遊水地
River improvement works





sin in Urban area

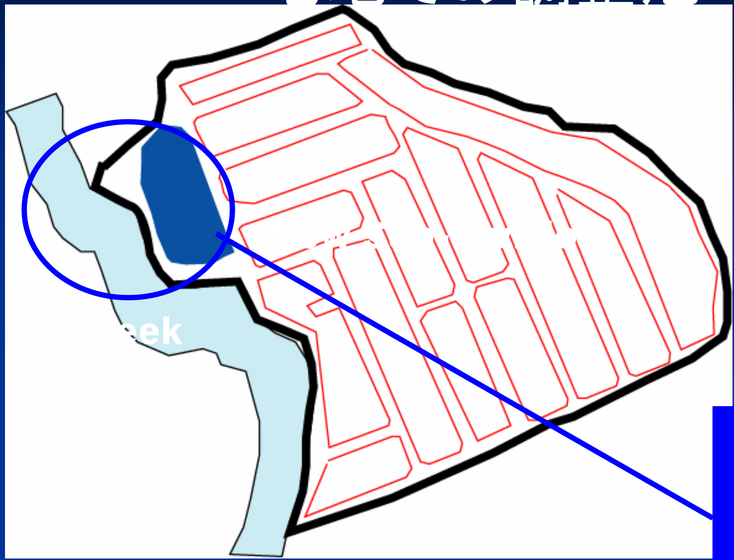
適応策 Climate Change Adaptation
土地利用規制 Land Use Control



Description	Peak River Discharge before Retarding	Peak River Discharge after Retarding	Reduction of Peak Discharge	Storage Volume	Area
Proposed in the Study	430 m^3/s	245 m^3/s	185 m^3/s	1.87 ($10^6 m^3$)	45ha
Required in 2050 B1 Scenario	550 m^3/s	245 m^3/s	305 m^3/s	3.01 ($10^6 m^3$)	75ha
Required in 2050 A1FI scenario	690 m^3/s	245 m^3/s	445 m^3/s	4.06 ($10^6 m^3$)	100ha

気候変動適応　Climate Change Adaptation

宅地での調整池　On-site Regulation ponds



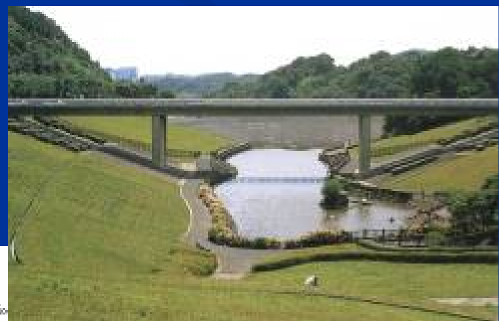
- Offset increment of peak runoff discharge
- Control sediment runoff

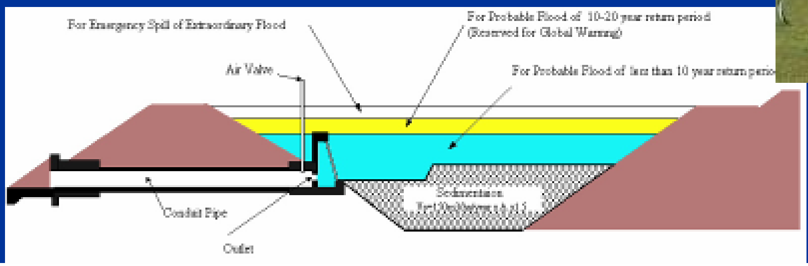
Dry Type

On-site Flood Regulation Pond

(3% of Sub-Division)

Wet Type

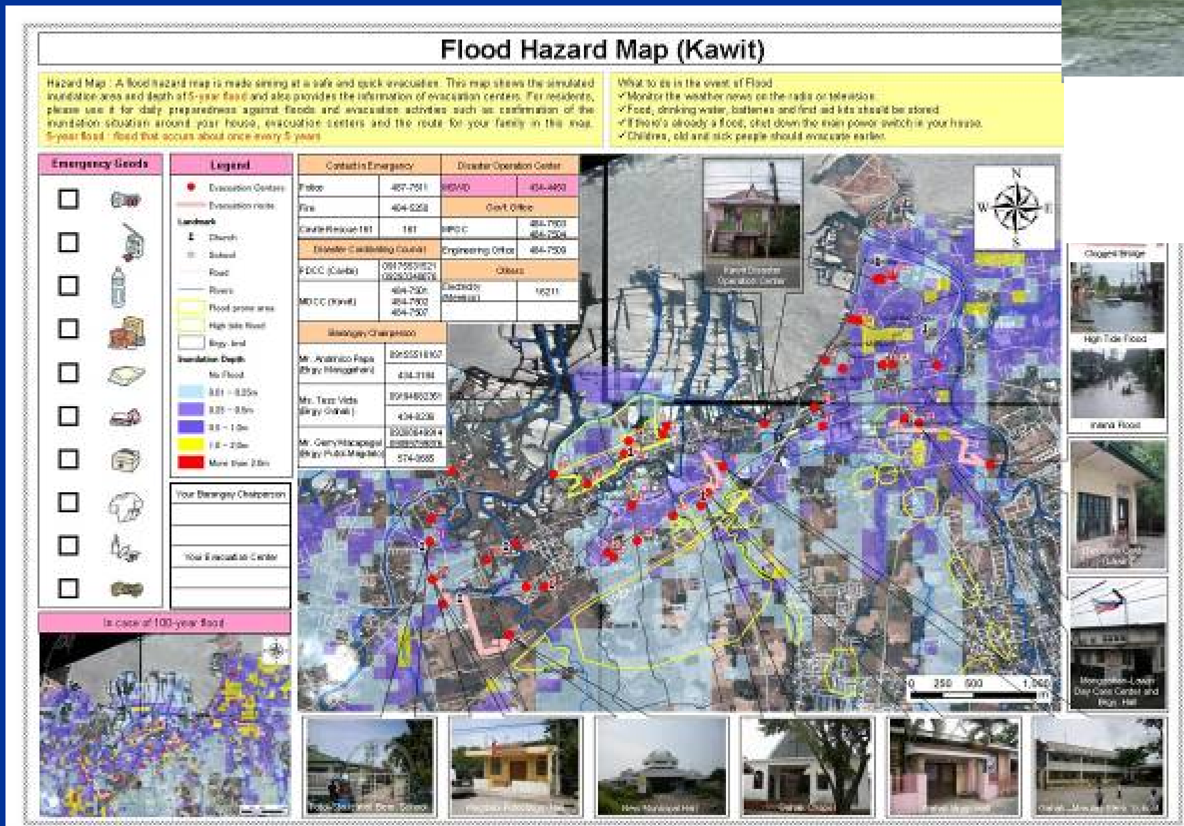




適応策　Climate Change Adaptation

ソフト対策　Software measures

ハザードマップ



適応策　Climate Change Adaptation

コミュニティ防災　Community based disaster management

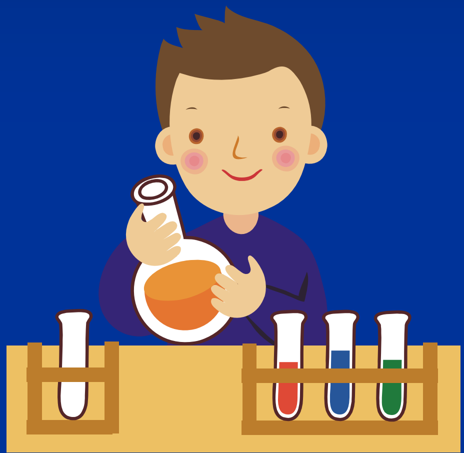
適応策　Climate Change Adaptation

コミュニティ防災　Community based disaster management




JICA handbook

Ver.0 was produced (sorry only in Japanese)



Ver.1 will be issued at the end of FY2010

Comments are welcomed

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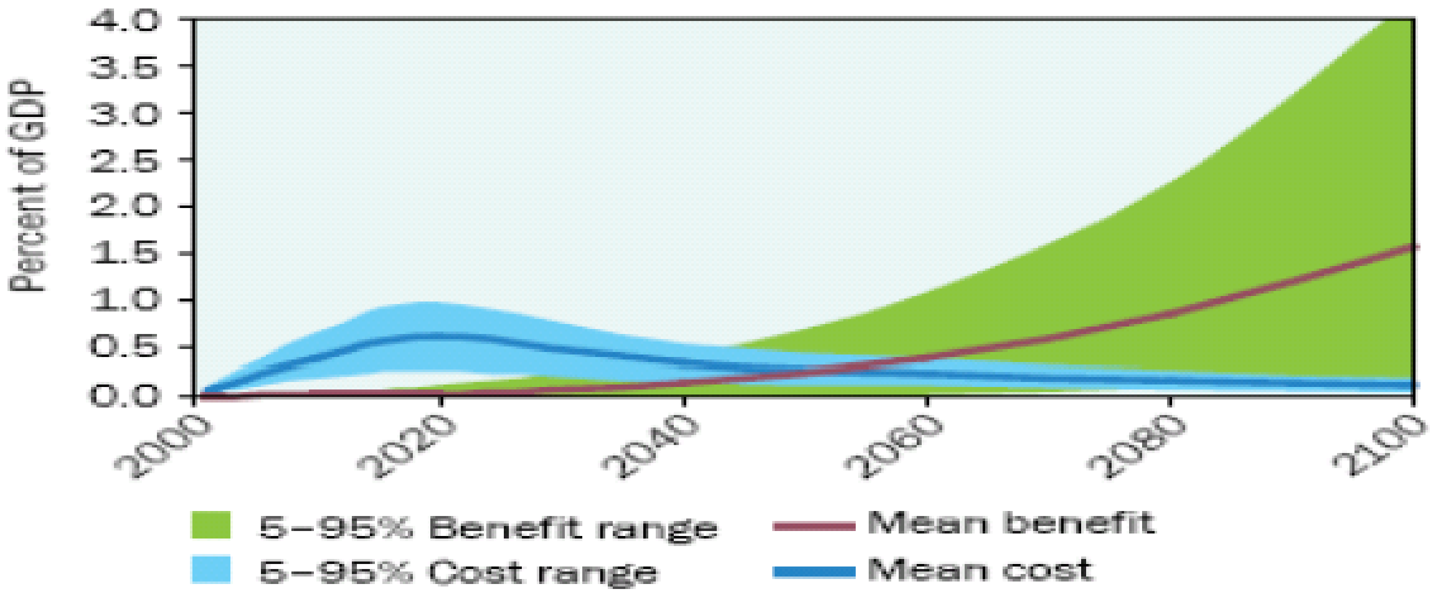
Figure H13. Cost and Benefit of Adaptation



Note: 'mean' indicates the average outcome of the simulations and the range of estimates from the 5th to the 95th percentile is shaded area. Benefit in terms of avoided damage is based on A2 scenario.

Source: ADB study team.

Stern: better spend 1% GDP now, than 5% GDP later!