Climate Change Adaptation in Disaster Management

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PECC STANDING COMMITTEE GENERAL MEETING AND RELATED MEETINGS

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Introduction

- Greater precipitation intensity and variability will increase flood risks in many areas (IPCC 4th assessment report)
- Developing countries are vulnerable
  - Already fragile environment, economic, social sensitivity (Mizra 2003, Stern 2007)
  - Developing countries bear 75-85% of damage (WB)
- Efforts today improve risk management in the uncertain tomorrow as well
  - No wait-and-see approach
- Objective: to propose method for CCA
  - Applied in the Philippines

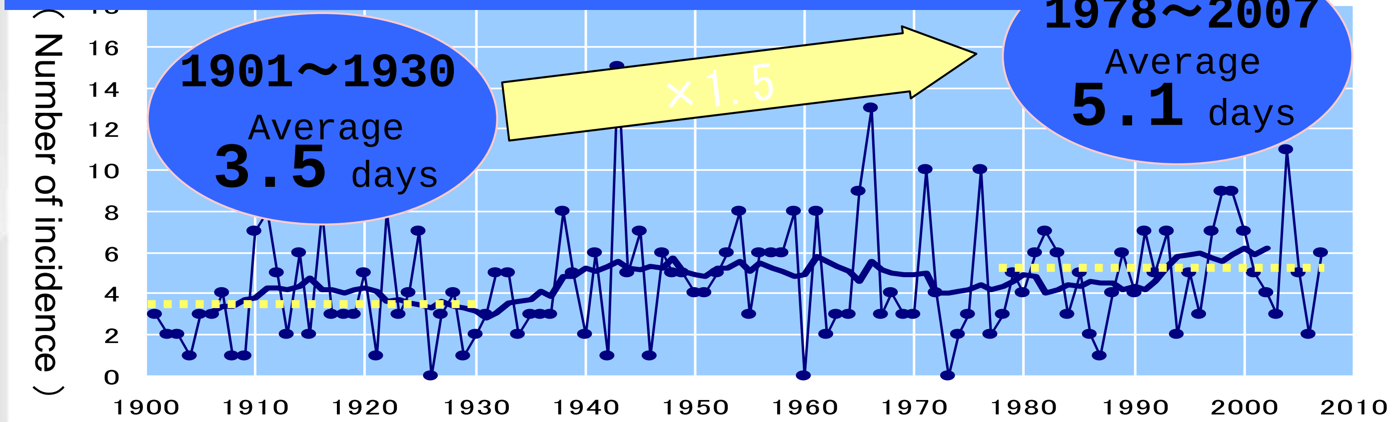
2. What is Happening in Japan?

Recent change on Climate in Japan

国土交通省

Daily rainfall over 200mm is significantly increasing

Incidence of daily rainfall over 200mm per year

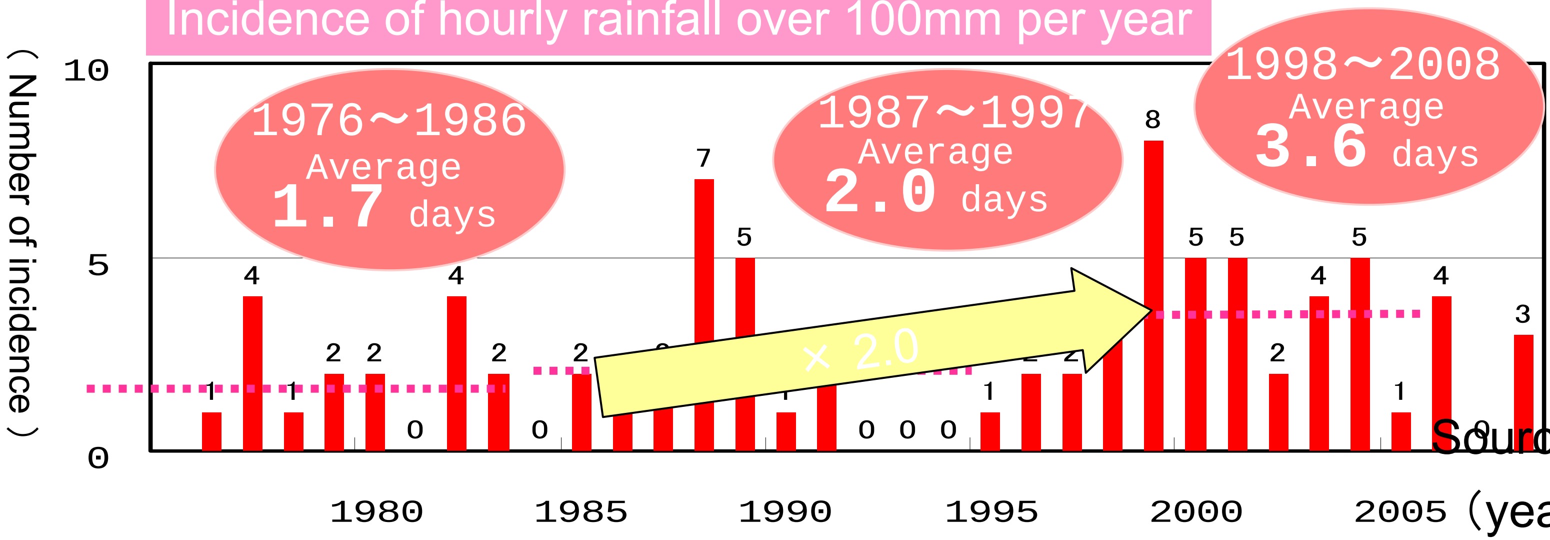


Source: JMA

（year）

Hourly rainfall over 100mm is increasing

Incidence of hourly rainfall over 100mm per year



Source: JMA

（year）

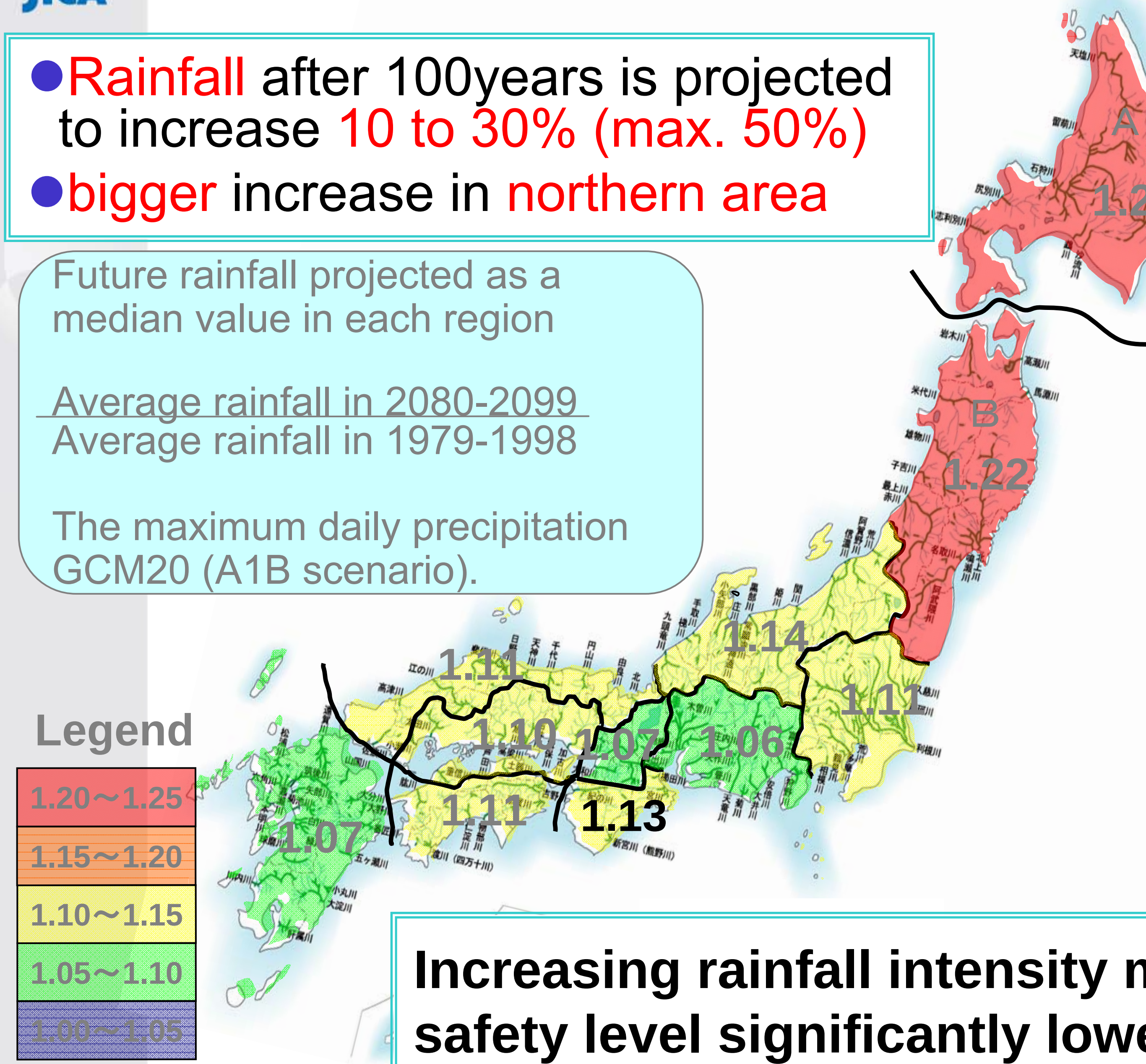
Projection of future Climate

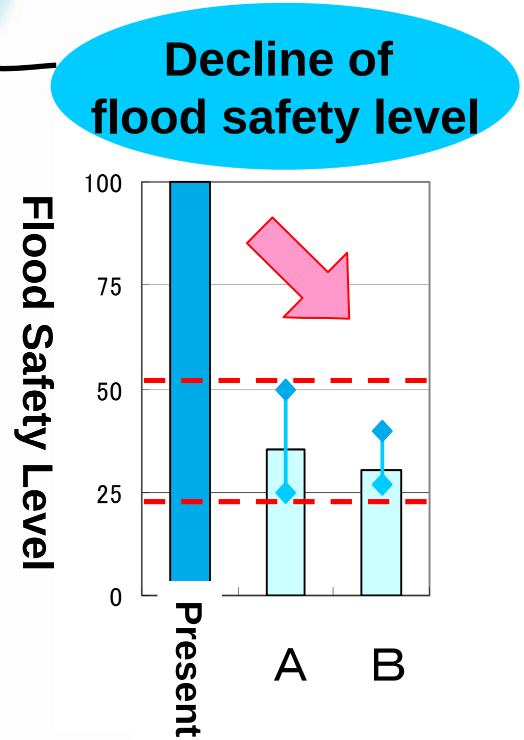
- **Rainfall after 100years is projected to increase 10 to 30% (max. 50%)**
- **bigger increase in northern area**

Future rainfall projected as a median value in each region

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

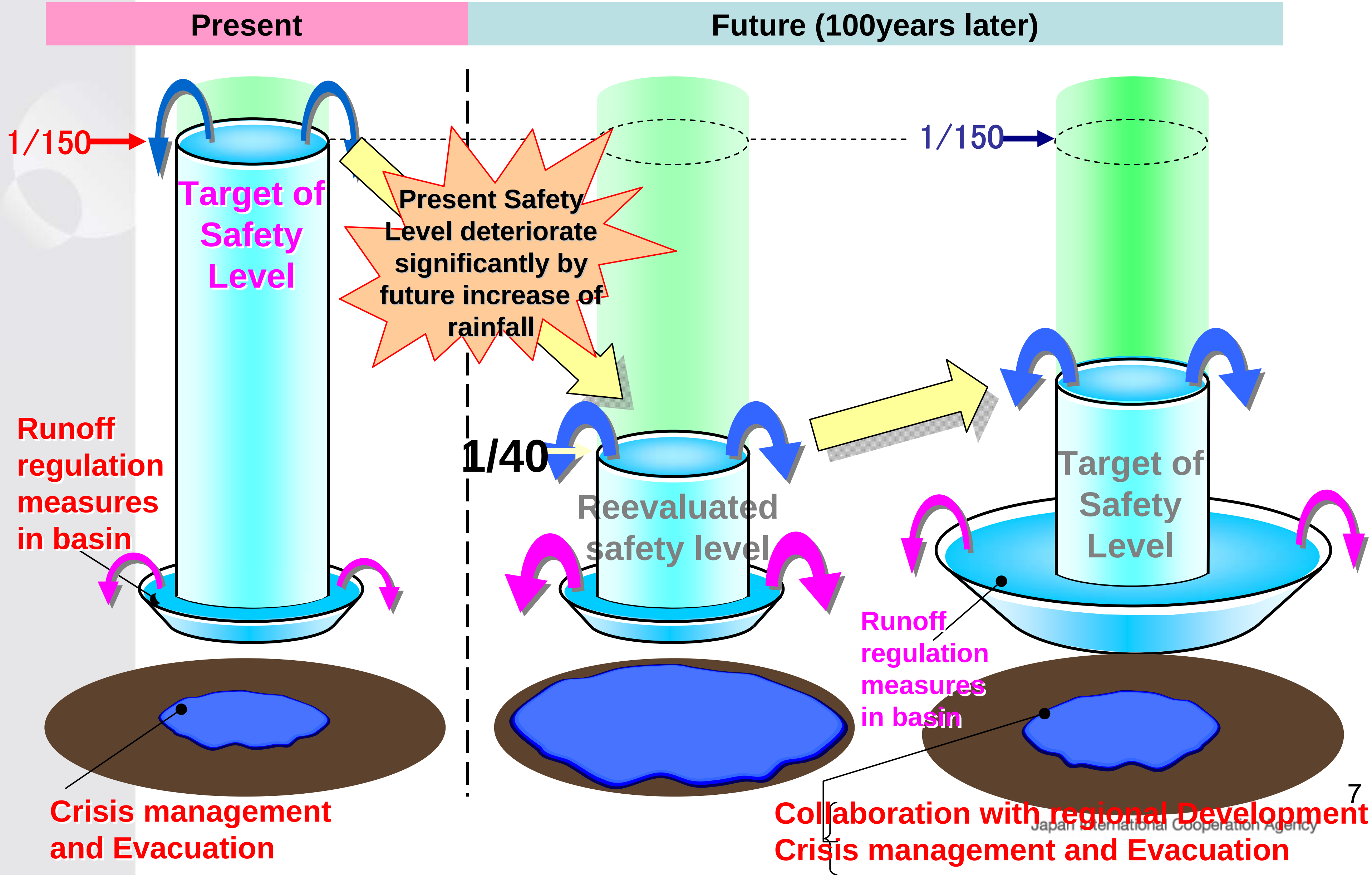
The maximum daily precipitation GCM20 (A1B scenario).





Increasing rainfall intensity make flood safety level significantly lower than present

Basic concept for managing increasing risks
- Multiple measures in flood management -



Flood Risk Management Under Changing Climate: JICA Handbook

“Stationarity is Dead” (Milly et al., 2008)

☺ Conventional Method of Water Planning

Assumption: rainfall pattern fluctuate within unchanging envelope of variability

☹ Under changing and uncertain climate

✓ Climate is changing

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

✓ Prediction possible, but with uncertainty

New Designing methods of water infrastructures are needed

River bank heights, reserve capacity, bridge heights etc.

Furthermore……

“Stationarity is Dead”

Is flood Control Philosophy Dead, as well?

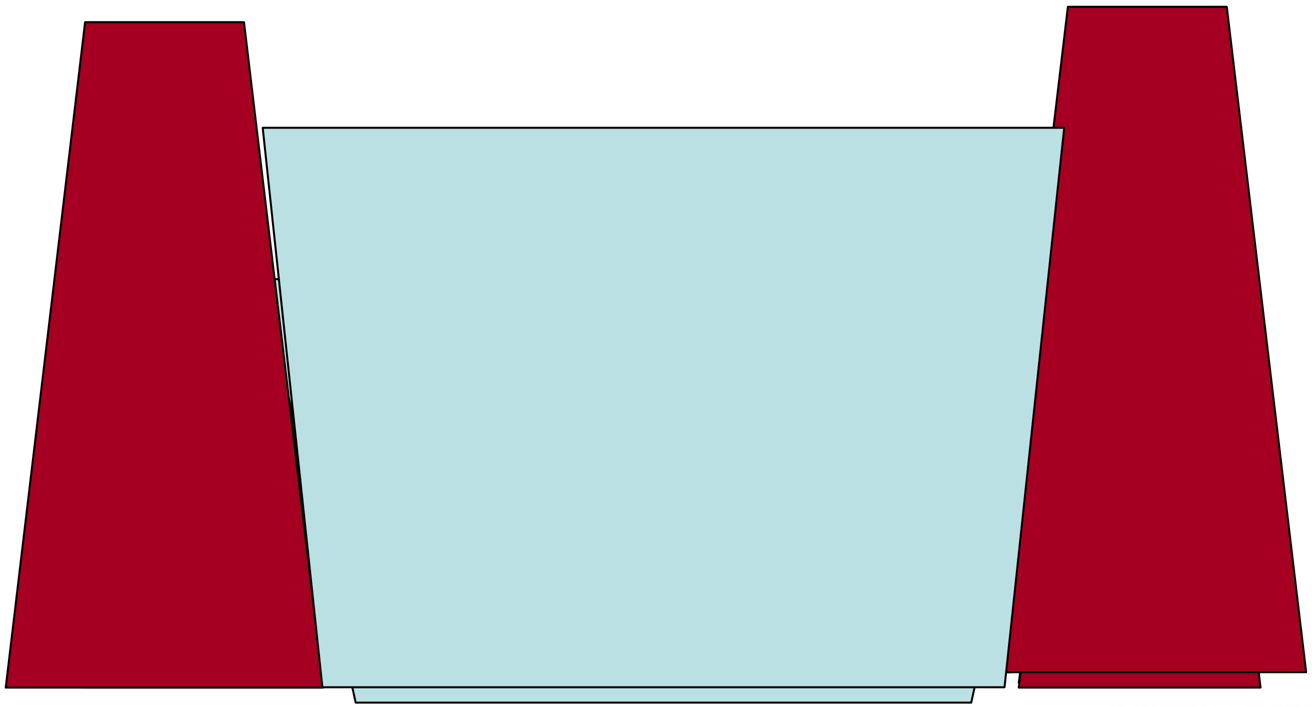
Source: MLIT

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

"Stationarity is Dead"

Is flood Control Philosophy Dead, as well?

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



Flood Risk Management Under Changing Climate: Proposed Method

Sustainable society resilient to 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

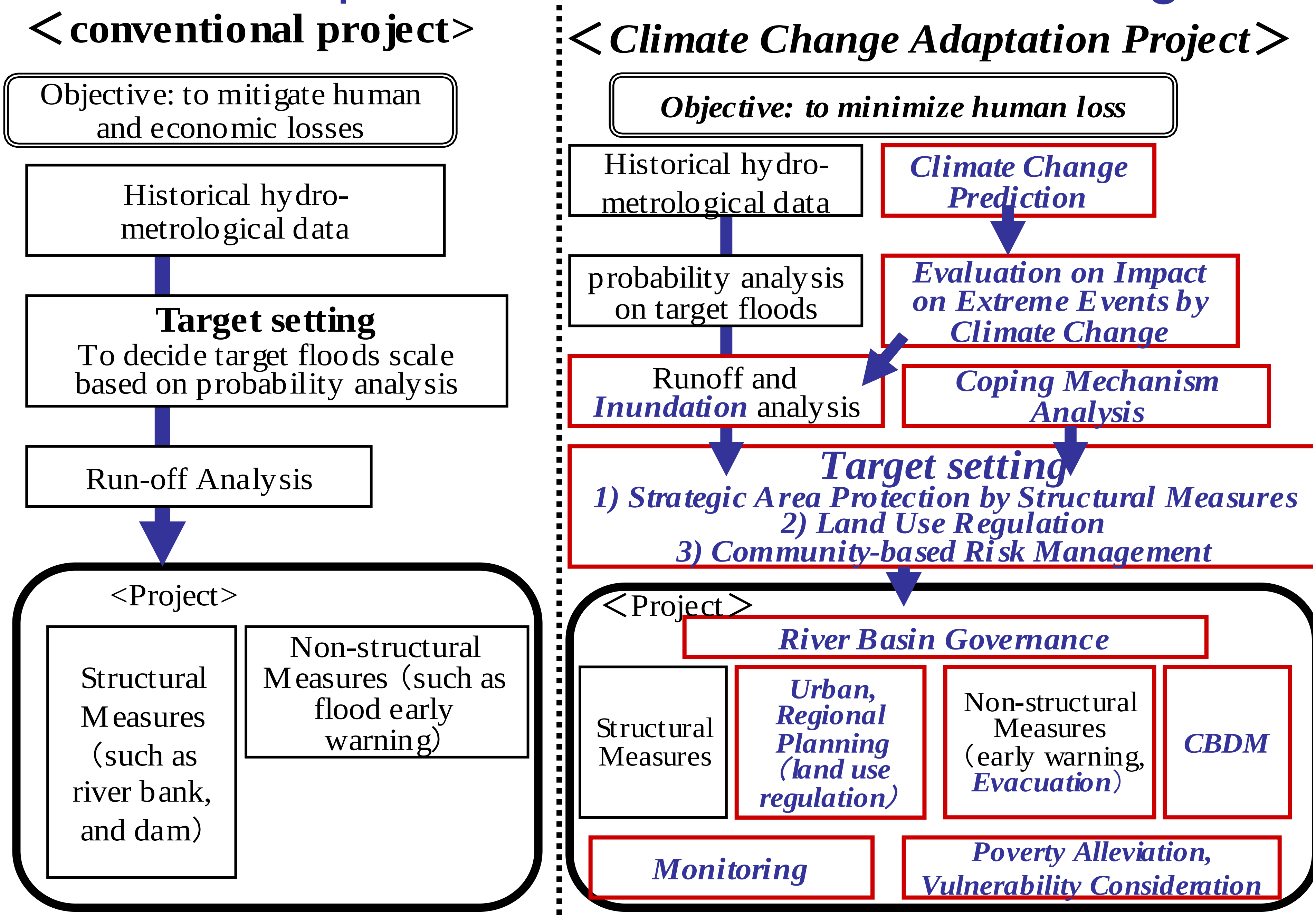
five basic concepts for an approach to coping with a changing and uncertain climate resiliently and sustainably

1. **Human security**: Focusing on individuals, particularly the most vulnerable
2. **Engagement with the society**: Engaging with the society as a whole, including policymakers and decision makers
3. **Building a sustainable adaptive society**: resiliently cope with a changing climate whose prediction entails uncertainty
4. **Disaster risk management**: focus on society's vulnerabilities, especially associated with urbanization, and adaptive capacity

$$\text{Risk} = \frac{\text{Hazard} \times \text{Vulnerability}}{\text{Capacity}}$$

5. **"Zero victim" goal of flood control**

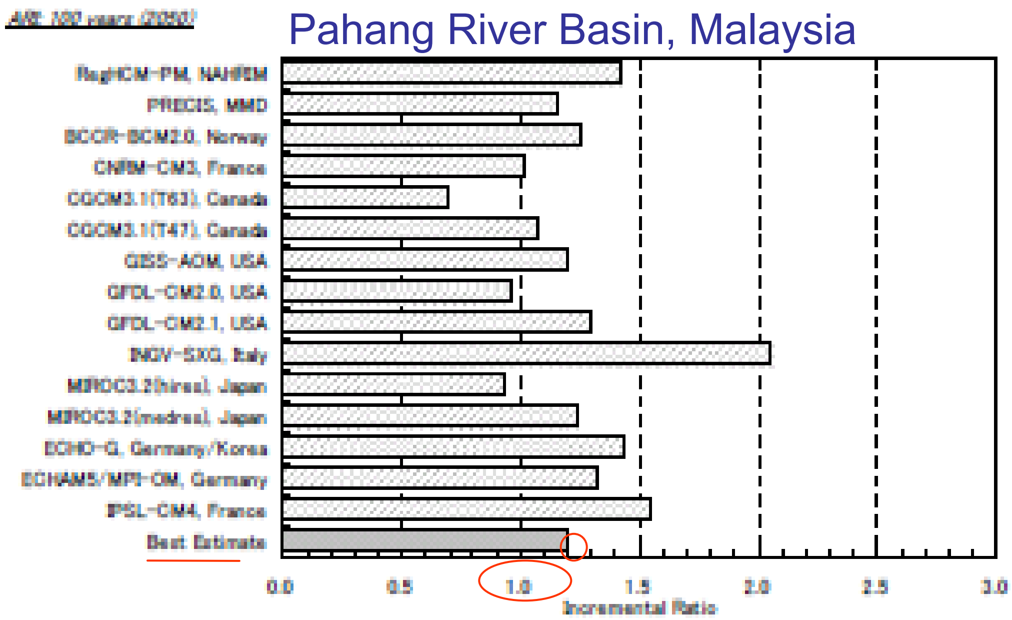
Proposed Method for CCA Planning



Climate change prediction Impact on Extreme Event

- Target year: Near-term 25-30 years
  - Comparatively low uncertainty, social factors not substantially affect climate
- Down-scaling
  - Statistical, Dynamic
  - Multi-model ensemble of GCM

Pahang River Basin, Malaysia



Climate change adaptation measures Flood Control Philosophy is Dead as Well.

- Conventional philosophy is abandoned

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

  "Multilayered measures in river basin"

  1) Step 1: Strategic area protect by structures

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

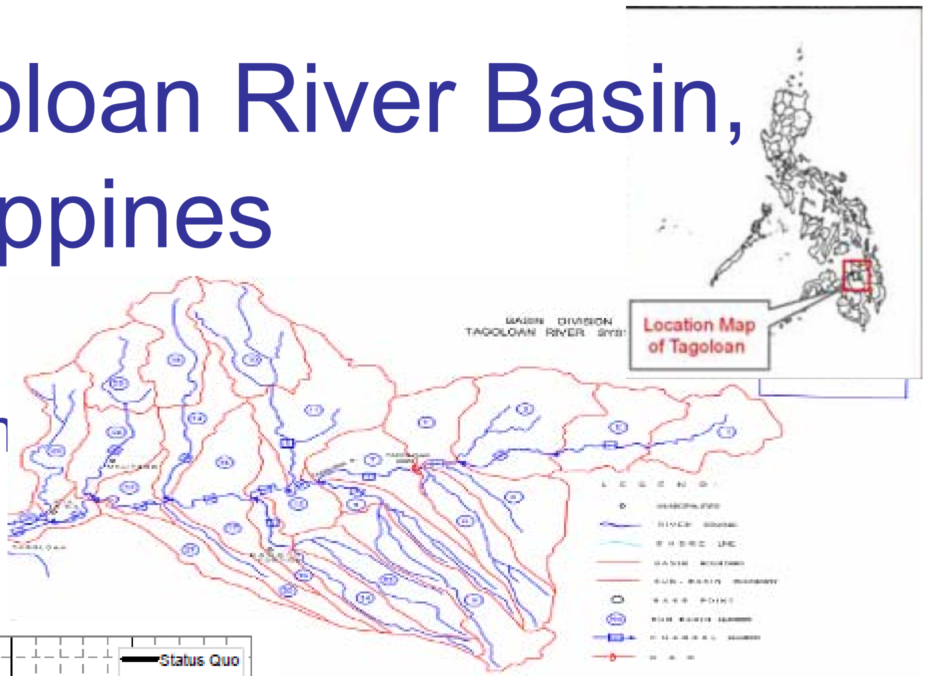
  3) Step 3: CBDM

Climate change adaptation measures

- Governance at river basin level
  - Involvement of various sectors, organizations, stakeholders
  - Need for consensus building and responsibility sharing
- Structure measures
- Non-structural measures: early warning and evacuation etc.,
- Land use regulation
- Community-based Disaster Management
- Capacity Development
- Monitoring
- Poverty alleviation and consideration on vulnerability group

Case Study 1: Tagoloan River Basin, the Philippines

- Catchments 1,778km2
- Precipitation 1,500-2,000m



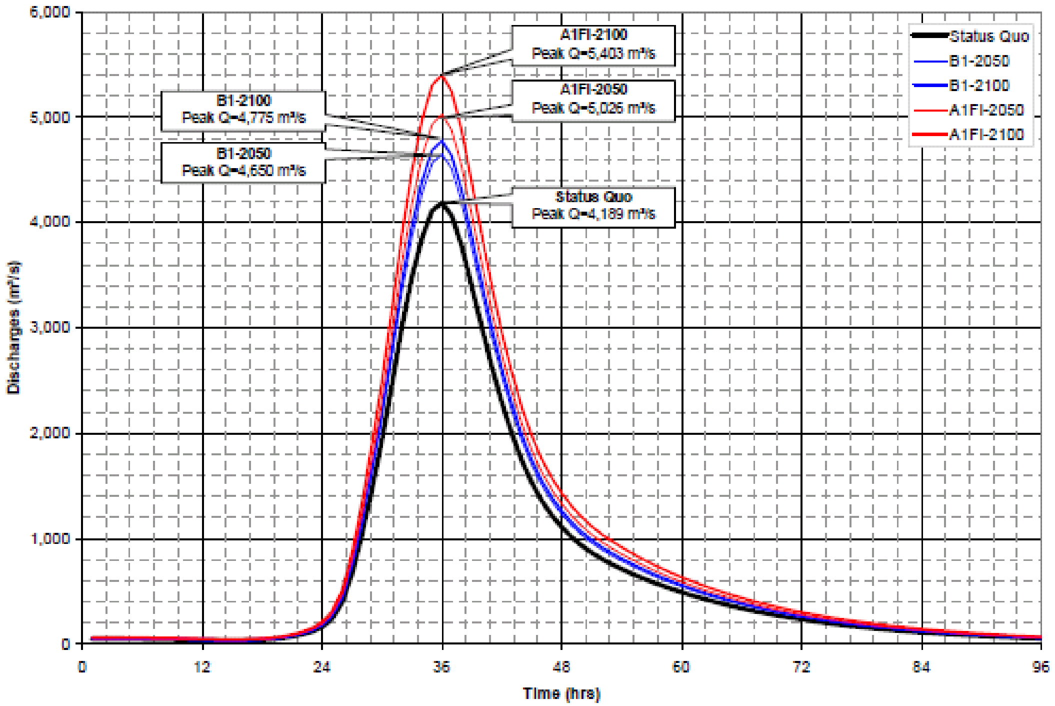
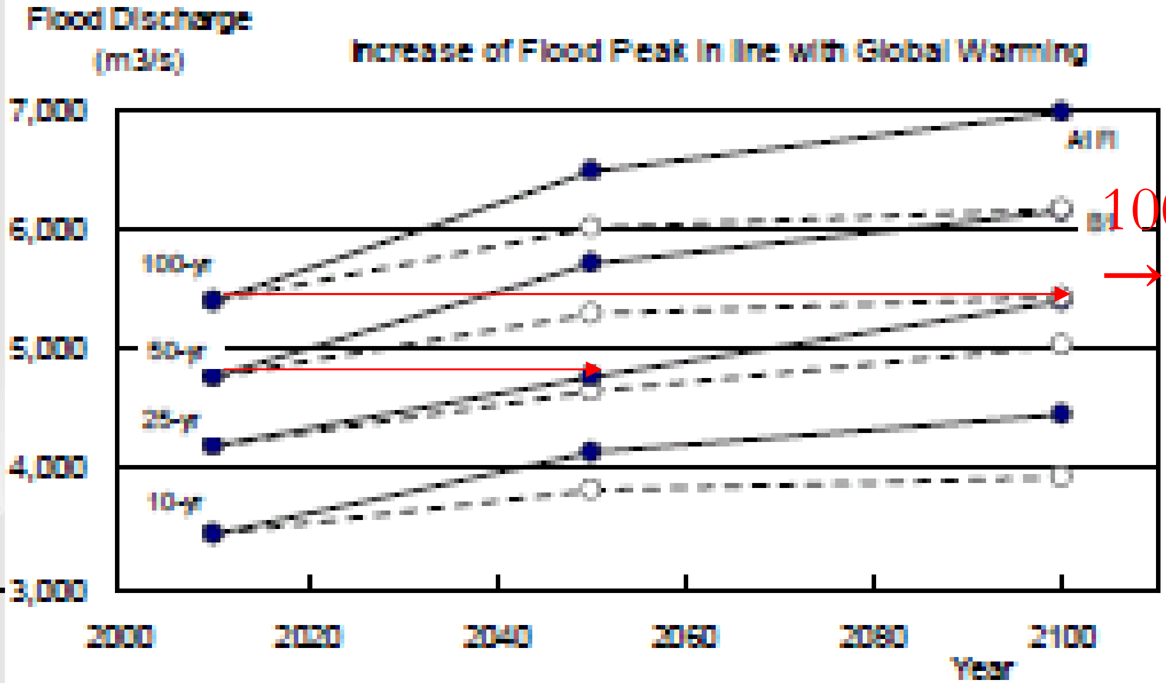


Figure R 10.16 Future 25-yr Probable Design Hydrographs

25-yr return period
4,200 in present
4,650-4,800 in 2050
5,000-5,300 in 2100



100 yrs flood
→ 25-50yr flood in 2100

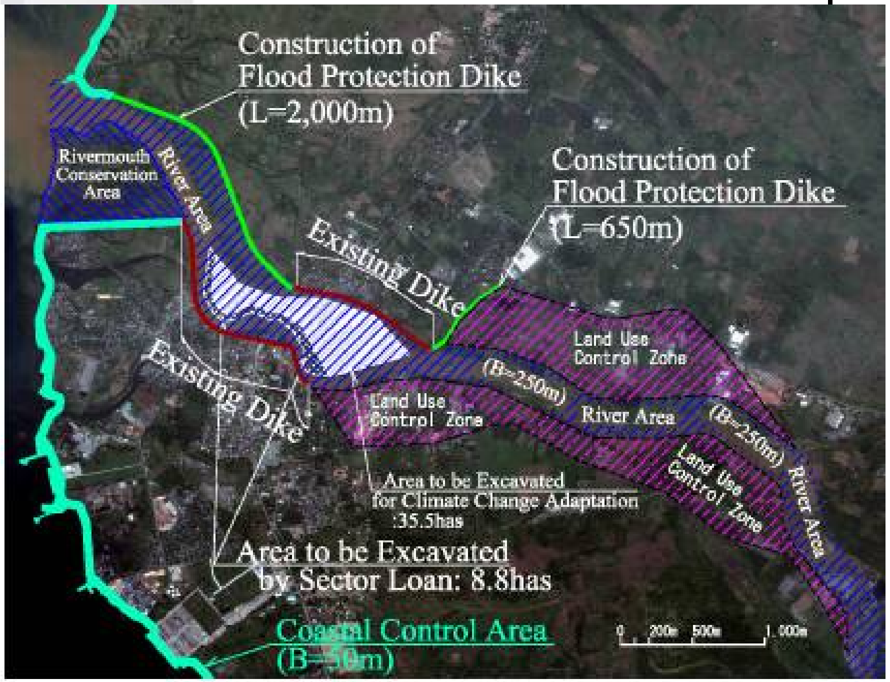
50 yrs flood
→ 25yr flood in 2050

Scenario		rainfall intensity (%)	Return period (year)	5yr	10yr	25yr	50yr	100yr	Probable Flood Discharge (m3/s) 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

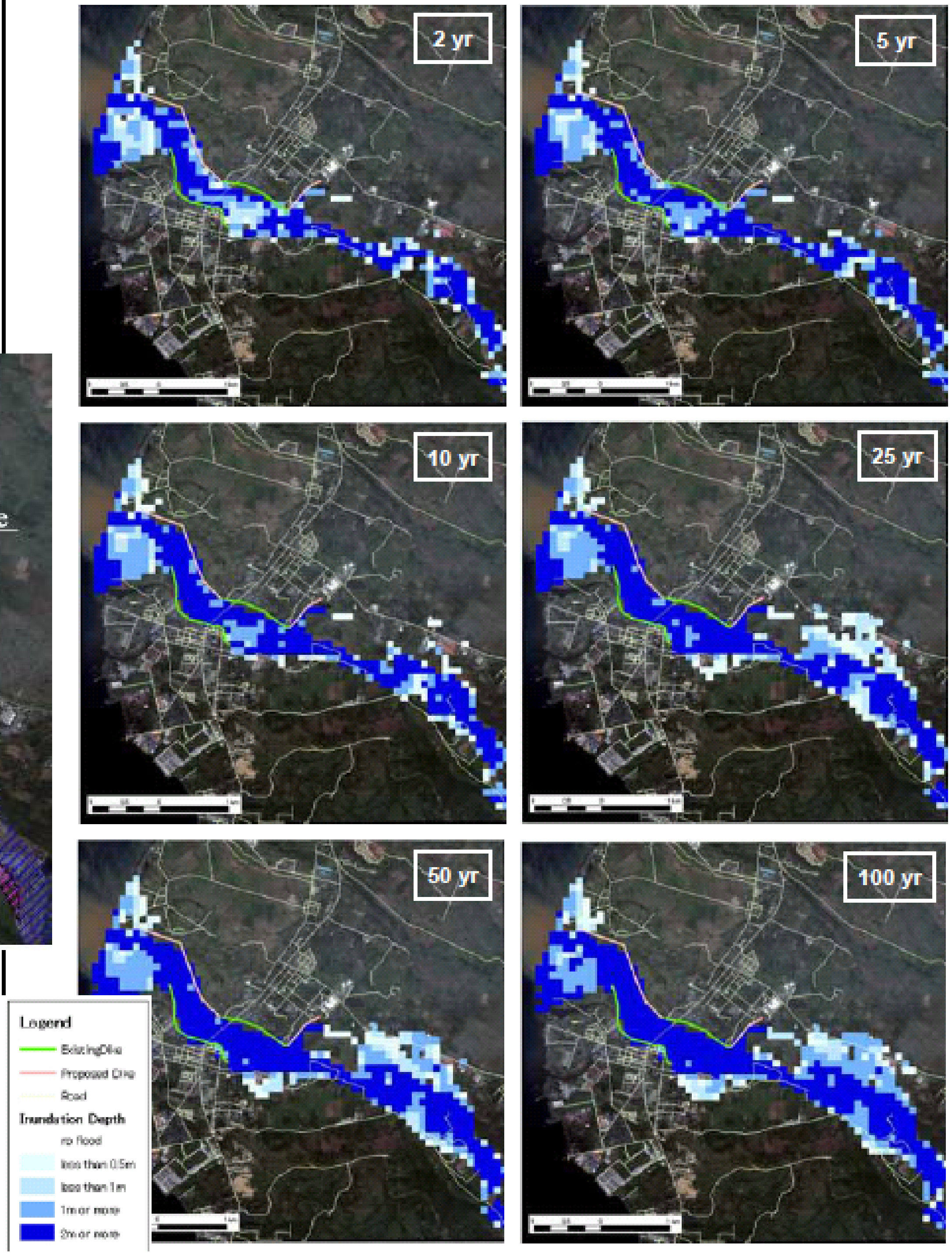
Revising Plan

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
Existing Dike
Land Use
Control Zone
(B=250m)
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)
0 200m 500m 1,000m



2 yr
5 yr
10 yr
25 yr
50 yr
100 yr
Legend
ExistingDike
Proposed Dike
Road
Inundation Depth
no flood
less than 0.5m
less than 1m
1m or more
2m or more

Case Study 2: Cavite,the Philippines

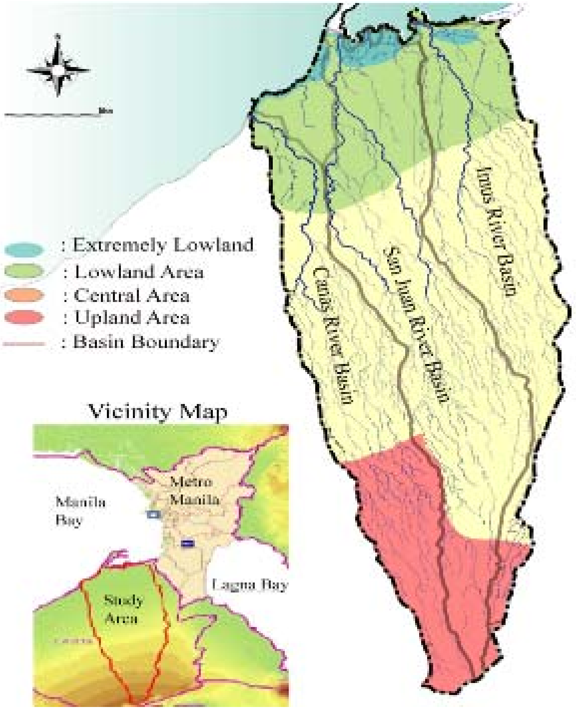
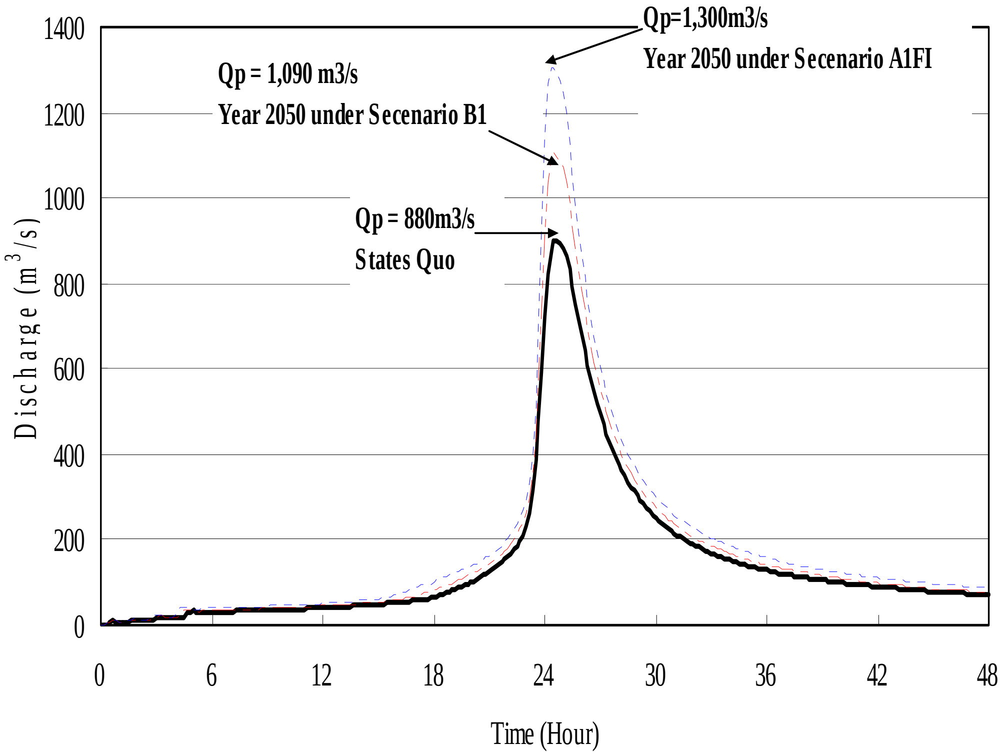
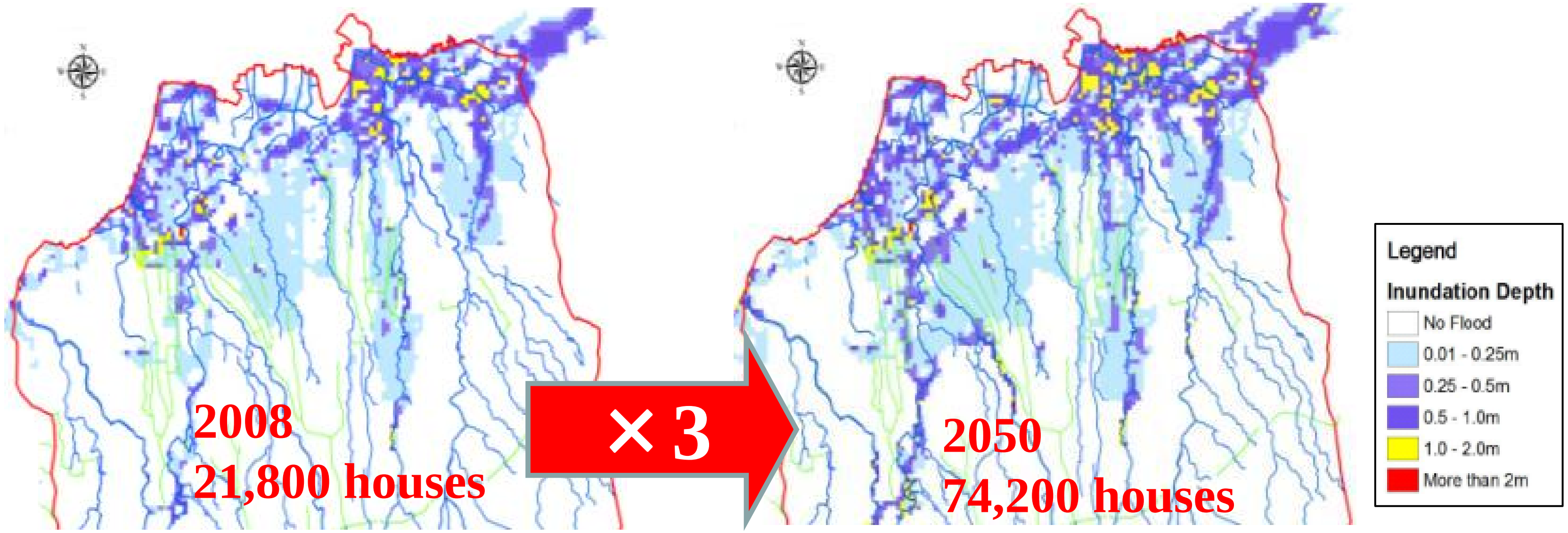


Fig. 1 General Map of Study Area



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	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**

Negative synergy effect of CC and Urbanization

都市化　Urbanization

気候変動
Climate Change

表面流
Surface flow

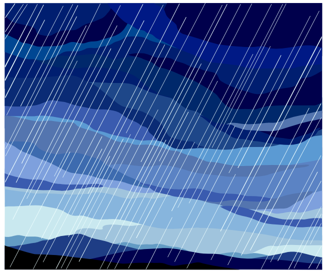
雨
Rain

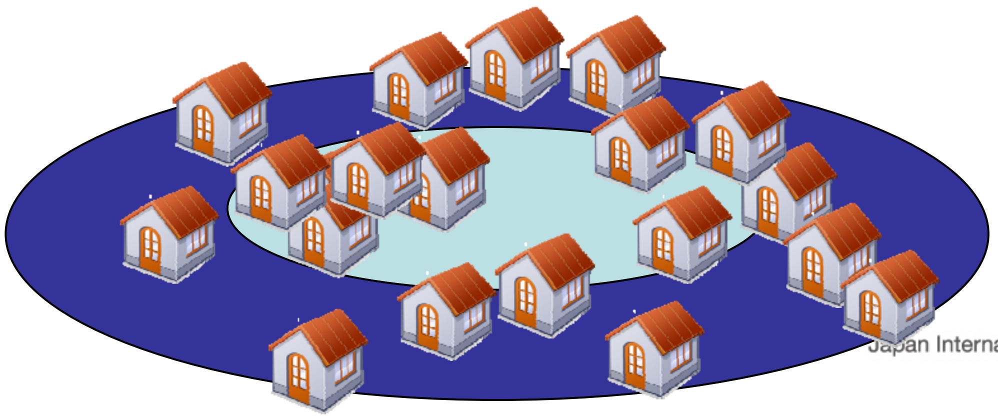
海面上昇
Sea Level

危険地域の家屋
Houses at risk area

洪水
Floods volume

危険地域
Risk area

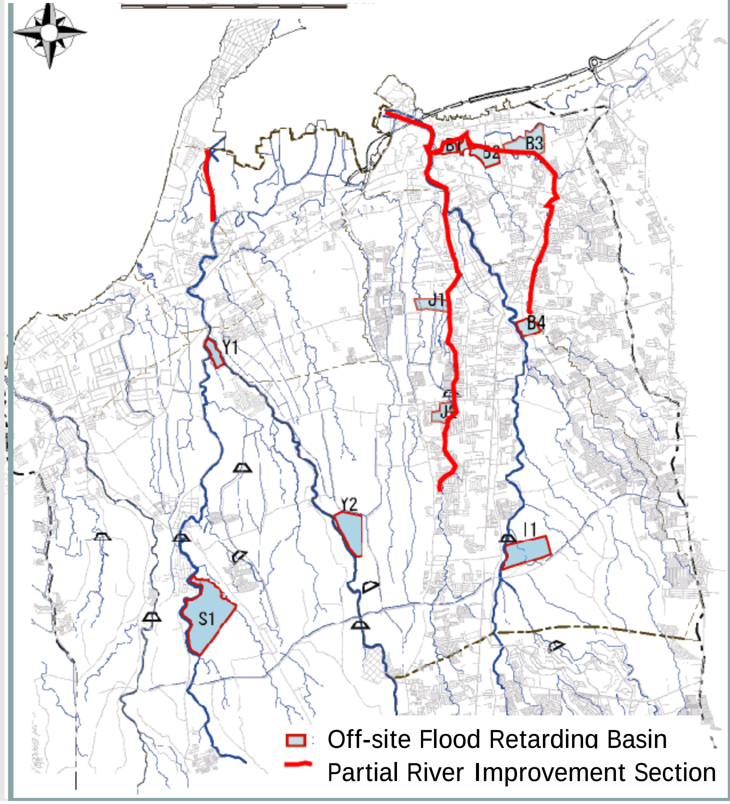




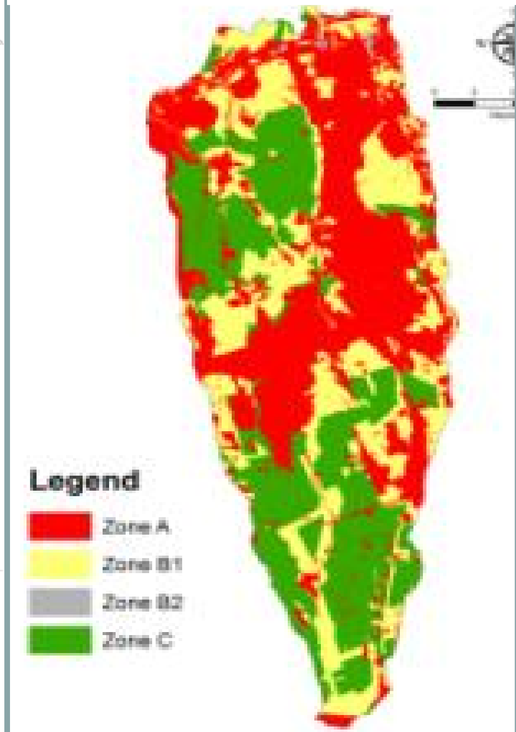
適応策検討　Climate Change Adaptation

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

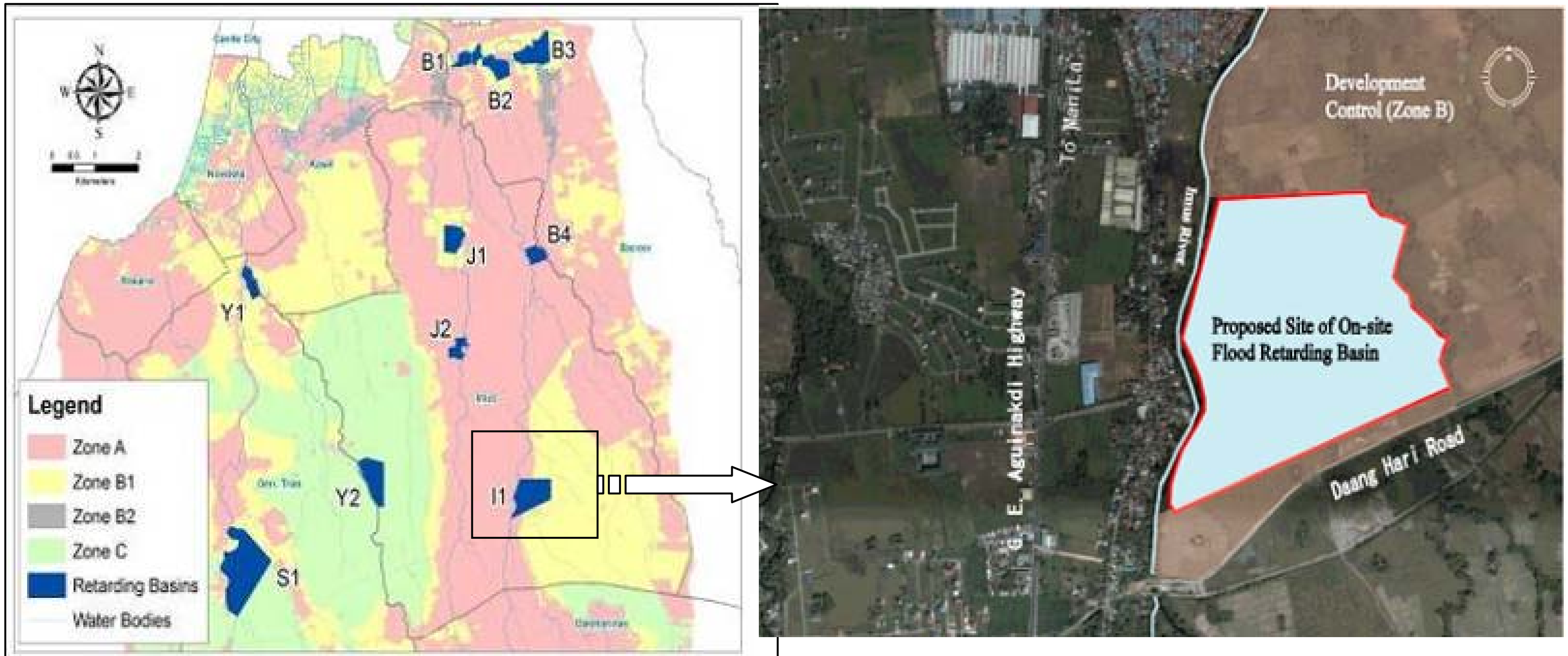


2.土地利用規制
Land Use Control



3. 調整池Retarding
Basin in Urban area

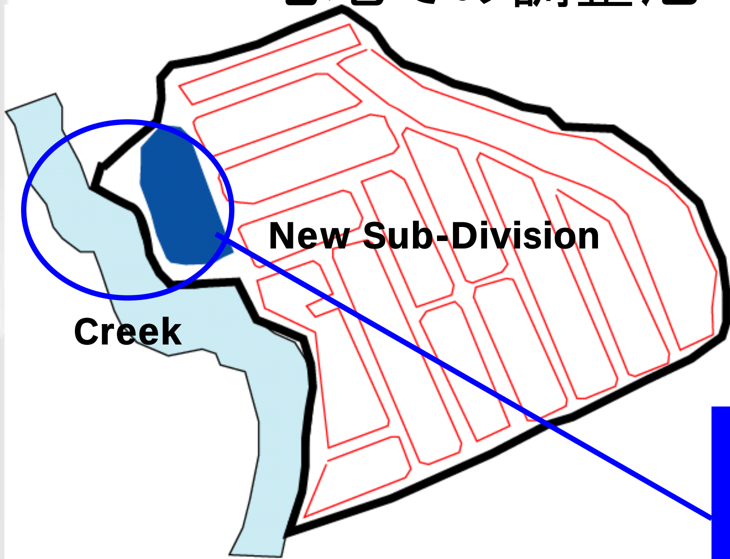
適応策 Climate Change Adaptation
土地利用規制　Land Use Control



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 (10^6m^3)	45ha
Required in 2050 B1 Scenario	550 m^3/s	245 m^3/s	305 m^3/s	3.01 (10^6m^3)	75ha
Required in 2050 A1FI scenario	690 m^3/s	245 m^3/s	445 m^3/s	4.06 (10^6m^3)	100ha

気候変動適応　Climate Change Adaptation

宅地での調整池　On-site Regulation ponds

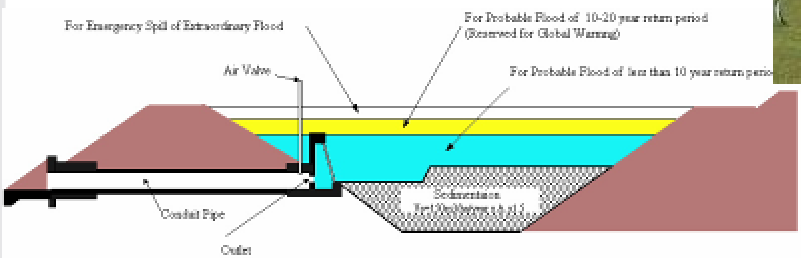


Dry Type

On-site Flood Regulation Pond

(3% of Sub-Division)

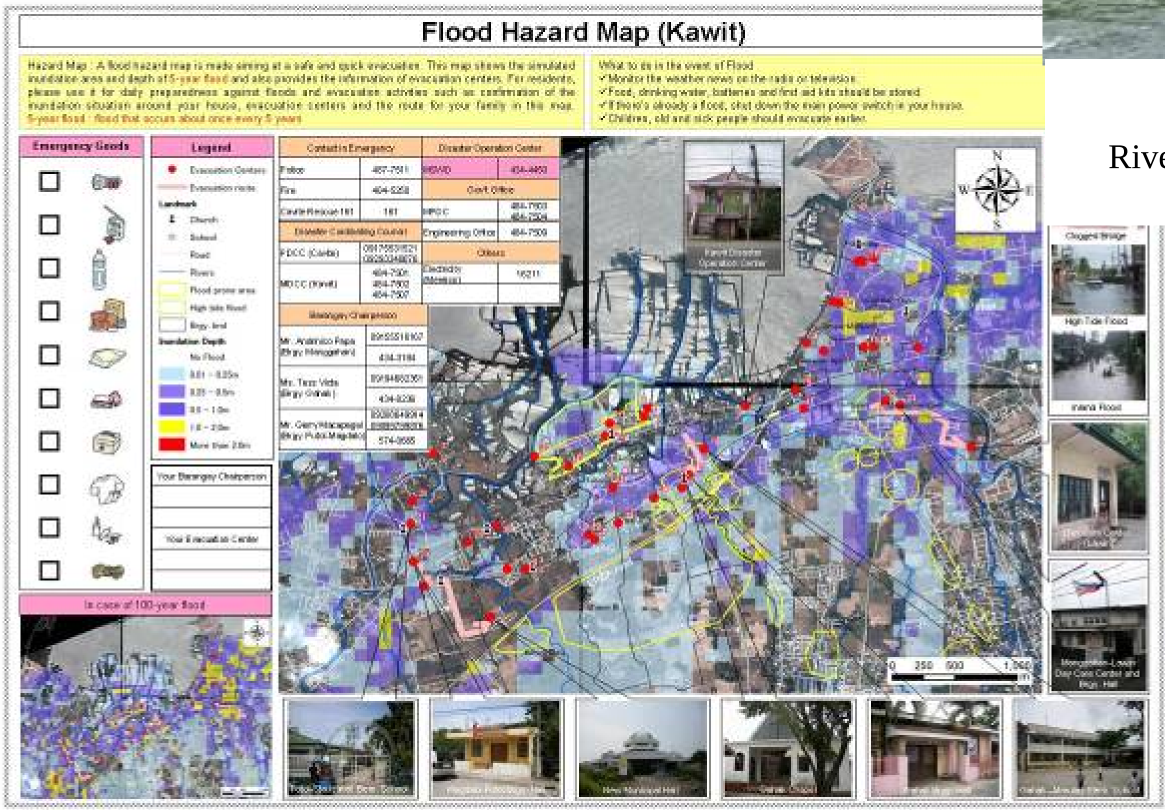
Wet Type



適応策　Climate Change Adaptation

ソフト対策　Software measures

ハザードマップ



簡易観測

River Water Level Indicator for Flood Warning and Evacuation

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

5. conclusion

- Climate is changing in Japan, and new policy is reported.
- Startionarity is dead, flood control philosophy either?
- JICA’s Handbook for Climate Change Adaptation in Water
- Proposed method of CCA in flood risk management is applied in the Philippines

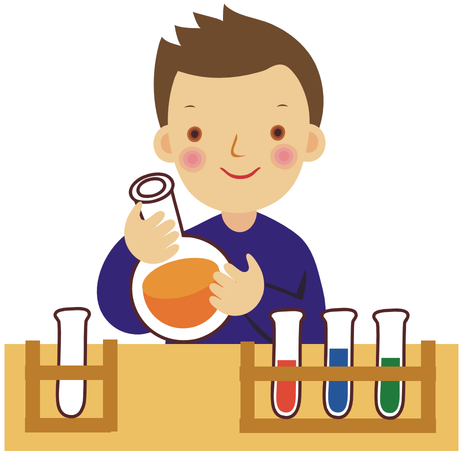
Recommendation for ASEAN+3

- JPN's Obligation

  based on technology and experience
  - To provide future prediction on precipitation, flood, drought
  - To provide advice on climate change adaptation
- Proposed Action for ASEAN+3
  - To standardize CCA procedures for achieving minimum requirement in any country
  - To share indigenous knowledge and practices
  - To conduct peer review

JICA handbook

Ver.0 was produced



Ver.1 will be issued at the end of FY2010

Comments are welcomed

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