

Recommendations of this study

6. Japan's response
to climate change

Climate change due to global warming is expected to induce the following phenomena in coastal and low-lying areas.

-More frequent heavy rains and more intense typhoons

➡ Frequent and serious flood and sediment disasters

-Sea level rise and more intense typhoons

➡ Frequent and serious high tides and coastal erosions

-Wider range of variation of rainfall intensity and change of river flow regime

➡ Frequent and serious droughts

Recommendation1. Basic concept for Future ideal society

Combining mitigation and adaptation aiming at "Sustainable and Water Disaster Adaptable Society"

Recommendation2. Basic direction of climate change adaptation measures

1. Adaptation measures to achieve "zero casualty" should be considered because "Zero damage" from disasters is difficult.
2. In a nerve center like the Tokyo metropolitan area, intensive efforts should be made such as preventing from ceasing national function

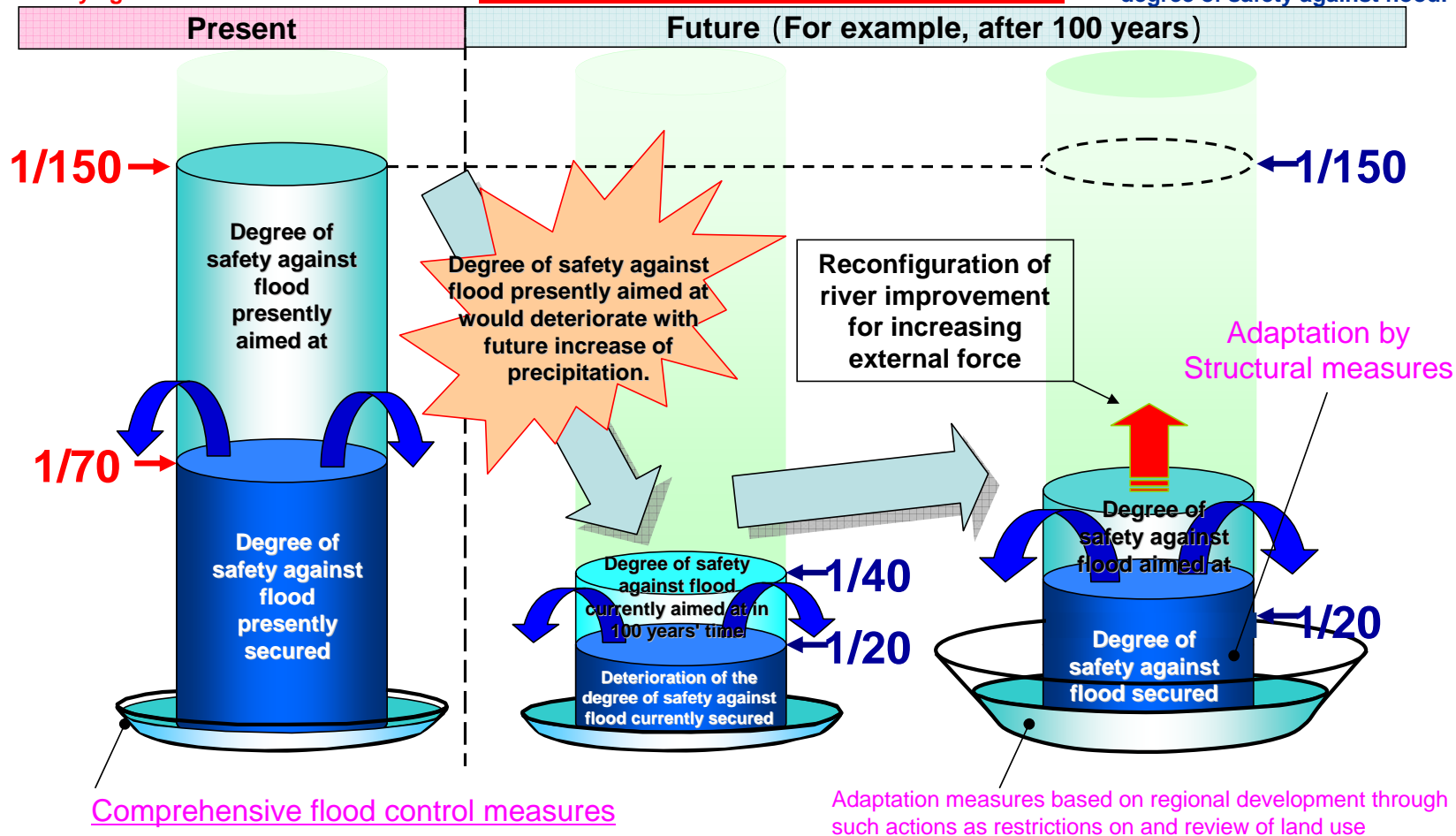
Recommendations3. Multiple measures for increasing in hazard

6. Japan's response to climate change

Red figures indicate present degree of safety against flood.

Image of flood disaster adaptation measures

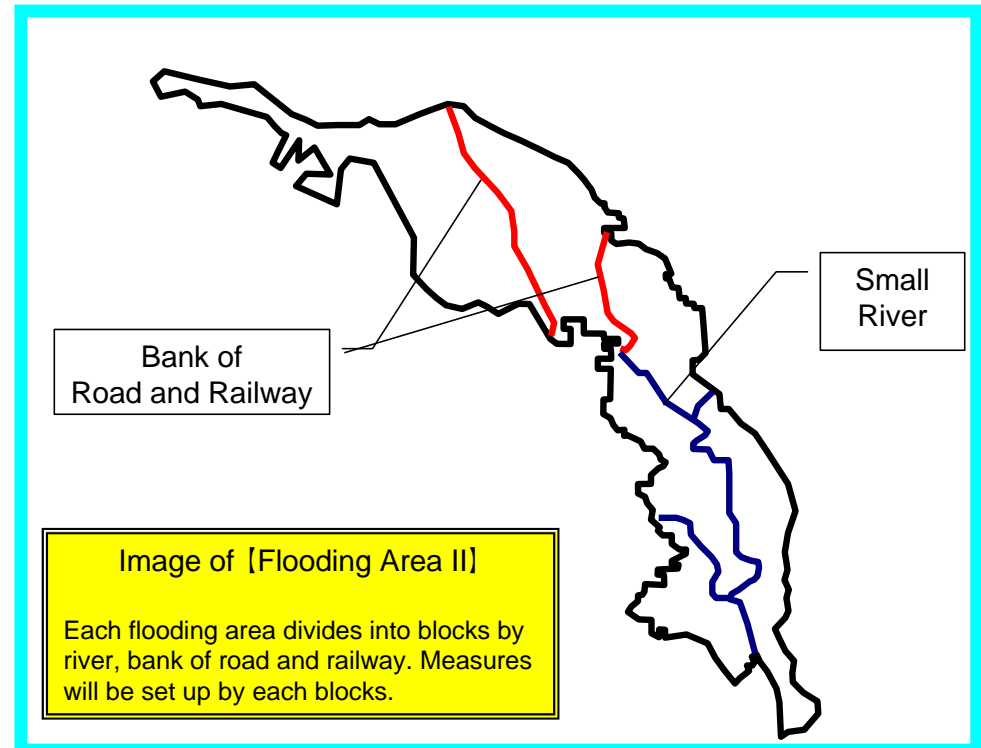
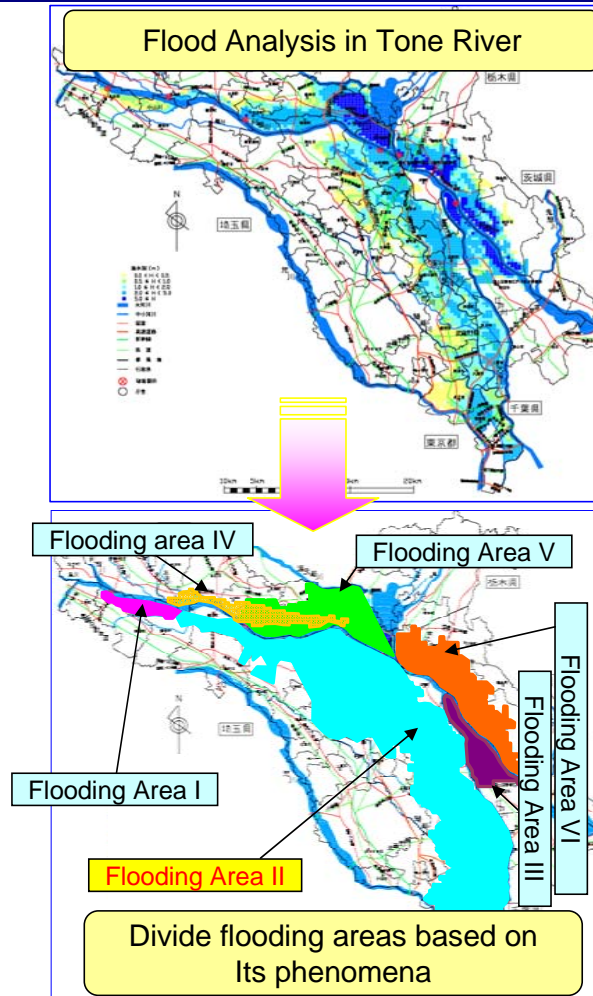
Blue figures indicate future degree of safety against flood.



Recommendation 4. Importance of Flood Risk Assessment

6. Japan's response to climate change

ex) Adaptation measures programming in river basin



Recommendation4. Importance of Flood Risk Assessment

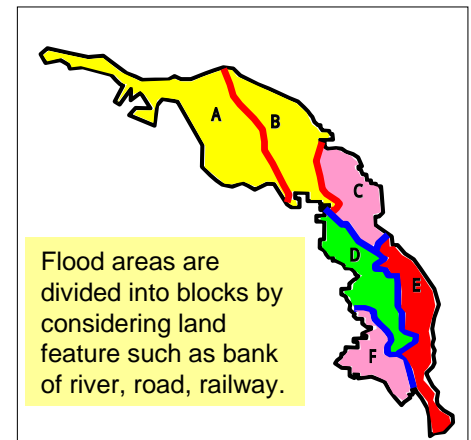
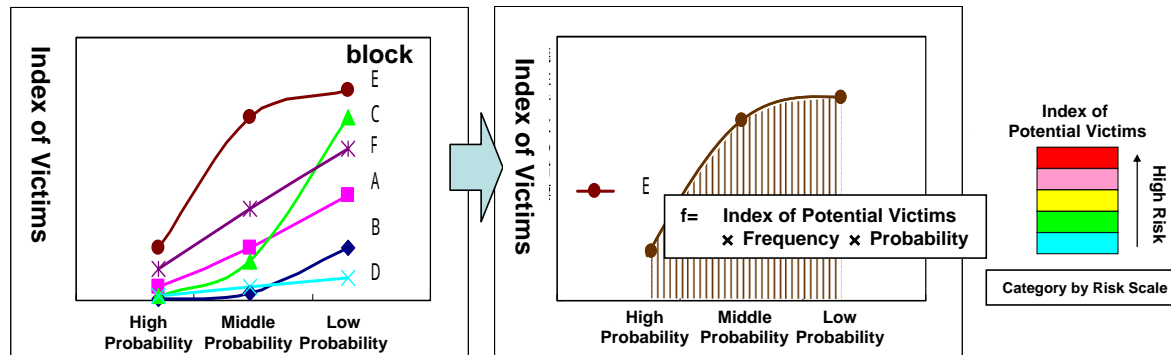
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Concept of Flood Risk Assessment

[Hazard Index] is increasing by Climate Change. For reduction of [Disaster risk], increasing [Disaster Prevention Index] and reducing [Affection Index] by adaptation measures such as improvement of facility, revise of land use, enforce of emergency response

$$\text{Disaster Risk} = \frac{\text{Hazard Index} \times \text{Affection Index}}{\text{Disaster Prevention Index}} \times \text{Probability}$$

- Hazard Index : Natural hazard and Land condition
(Climate, Hydrology, Land Feature, Geologic Condition, etc and Scale of Hazard)
- Affection Index : Social vulnerability of disasters
(Inundation people, Inundation houses, impacts of Road, Railway, Lifeline, etc)
- Disaster Prevention Index : Disaster prevention activity by Central Government, Local Government, community
(Present status of facility improvement, Public preparedness for disasters)

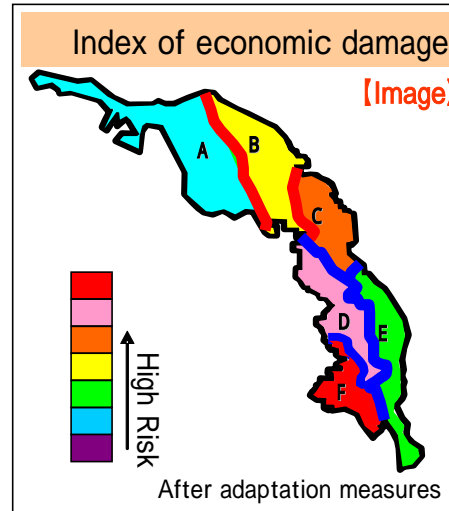
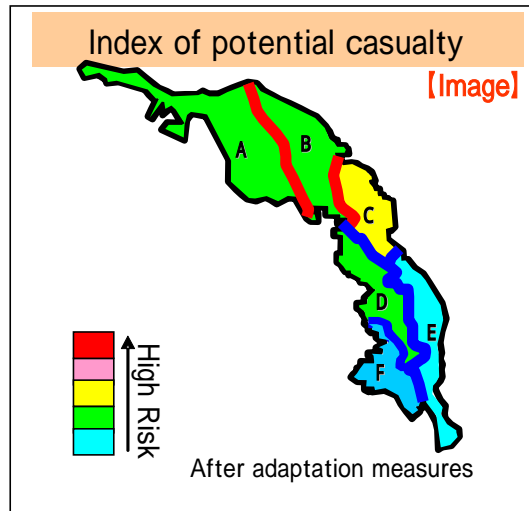


Recommendation4. Importance of Flood Risk Assessment

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Evaluation of risks and programming adaptation measures

Programming based on considering evaluation items, alternates and costs in each and mutual drafts



Necessity of considering multiple index of affection

Example of Affection Index

Affection Index f

- Potential Casualty
- Economic Damage
- Administrative Services Depression
- Inundate House
- Environmental Damage

Maximize target function under restriction of assessment contents and adaptation measures etc.

$$f = f_1 - f_2$$

$$f_i = f_i / C_i$$

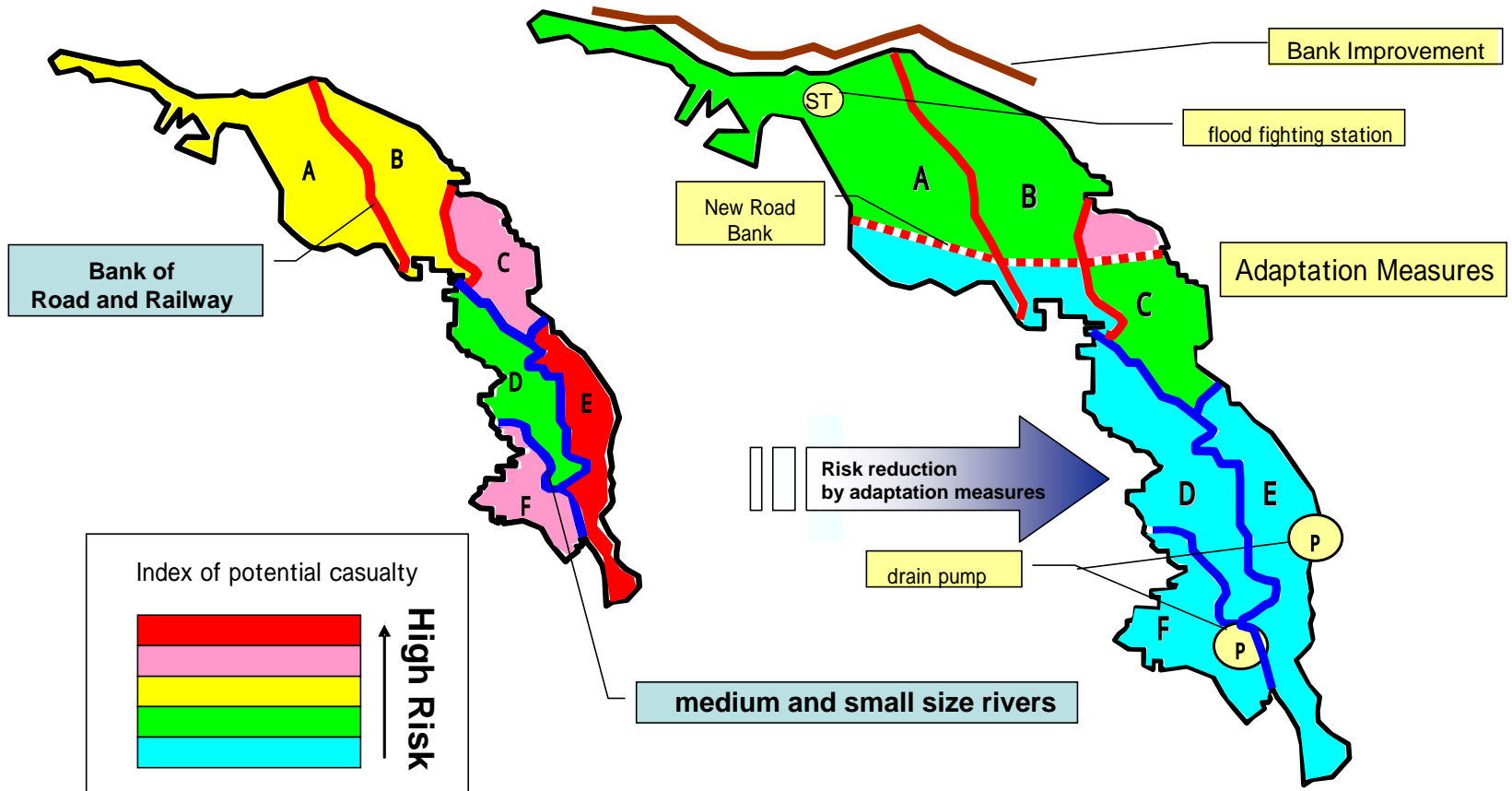
- f_1 : Current Affection Index
 f_2 : Affection Index after adaptation measures
 f : Reduction of Affection Index by adaptation measures
 i : Weighting factor of each assessment Affection Index
 n : Targeted evaluation items
 C : Cost

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Evaluation Risks and Programming adaptation measures

Expression effectiveness of risk reduction by adaptation measures by color difference



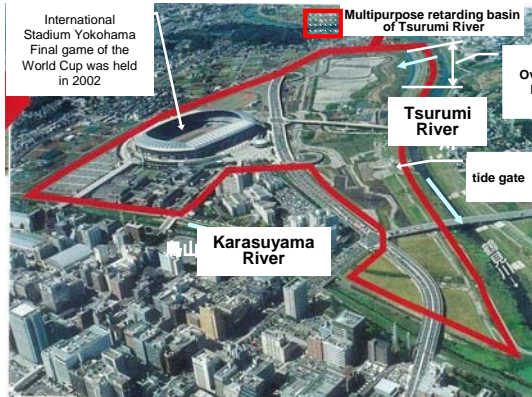
Recommendation 5. Appropriate combination of practical measures

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Adaptation measures by using structural method

Improvement of the credibility of structure, effective and multipurpose and long-life utilization of existing structure

Improvement structure



Multipurpose retarding basin of Tsurumi River



flood control (Dam)



River improvement of Tsurumi river

improvement of the credibility of structure (ex Coastal protection)

Before



aging revetment by deteriorated concrete



After



Rehabilitation of aging revetment by setting up anterior wall

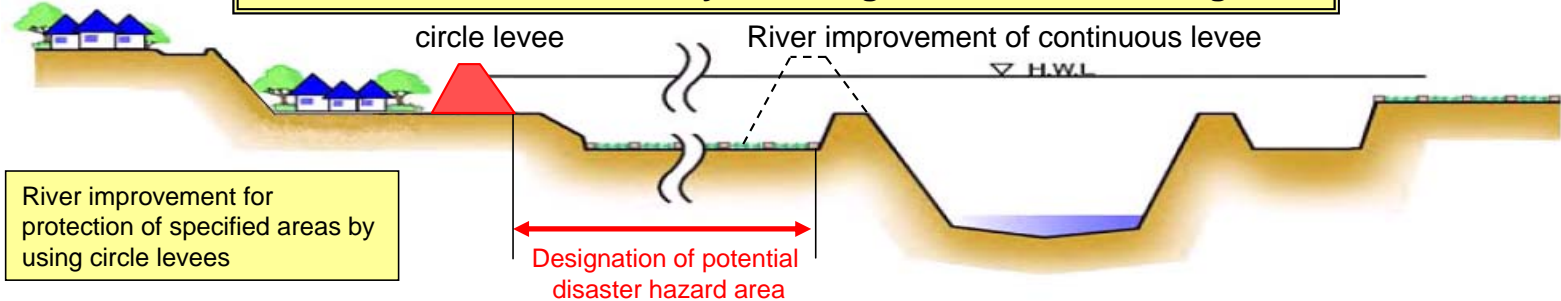
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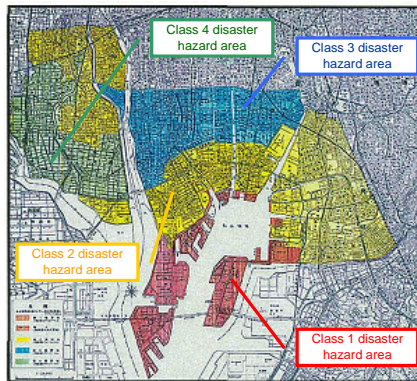
Adaptation measures by using regional development

Response to floods that cannot be dealt with by facility-based measures, through land use or community development allowing inundation.

Shift to land use or ways of living that minimize damage



Restrictions on land use by designating potential disaster hazard areas



名古屋市臨海部防災区域図

Sample ordinance restrictions (Nagoya City)

	1階の床の高さ	構造制限	図解	
第1種区域	N・P(+) 4m以上	木造禁止		<ul style="list-style-type: none"> *建築物の建築禁止 範囲...海岸線・河岸線から50m以内で市長が指定する区域 制限...居住室を有する建築物、病院及び児童福祉施設等の建築禁止 木造以外の構造で、居住室等の床の高さをN・P(+) 5.5m以上としたものについては建築可能
第2種区域	N・P(+) 1m以上	2階以上に居室設置 緩和...延べ面積が100㎡以内のものは避難室、避難設備の設置による代替可		<ul style="list-style-type: none"> *公共建築物の制限 (第2種～第4種区域) 範囲...学校、病院、集会場、官公署、児童福祉施設等その他これらに類する公共建築物 制限...1階の床の高さN・P(+) 2mかつN・P(+) 3.5m以上の居室設置
第3種区域	N・P(+) 1m以上			
第4種区域	N・P(+) 1m以上	2階以上に居室設置		

Shift to community planning resistant to inundation



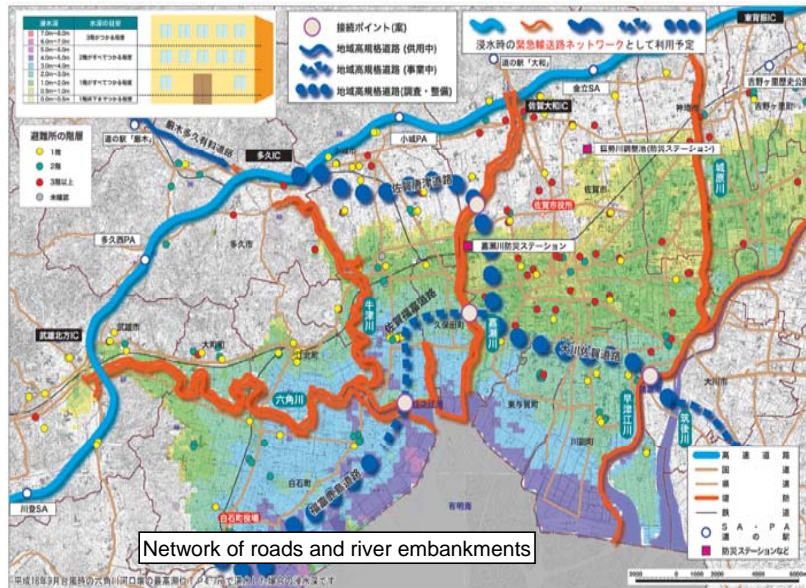
Adopting pilotis to prevent damage to buildings during a flood

Recommendation5. Appropriate combination of practical measures

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Adaptation measures centering around risk management

Building of a wide-area disaster prevention network that connects embankments, roads on the dry river bed for emergency traffic and elevated roads to wide-area disaster prevention bases.



Inundation of Route 34 during a flood in July 1990

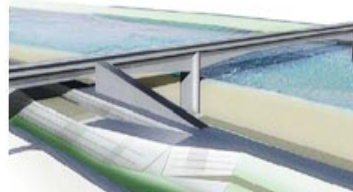
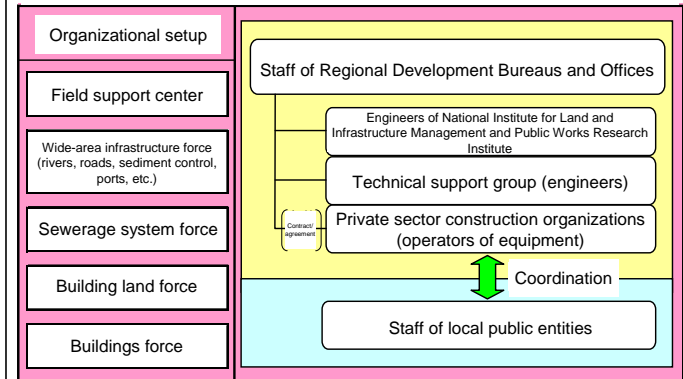


Image of road-embankment connection

Reinforcement of actions in the initial stages of a disaster for minimizing damage and restoring infrastructure early, and enhancement of an organizational setup to achieve the goal

Technical Emergency Control Force (TEC-FORCE)



Activities

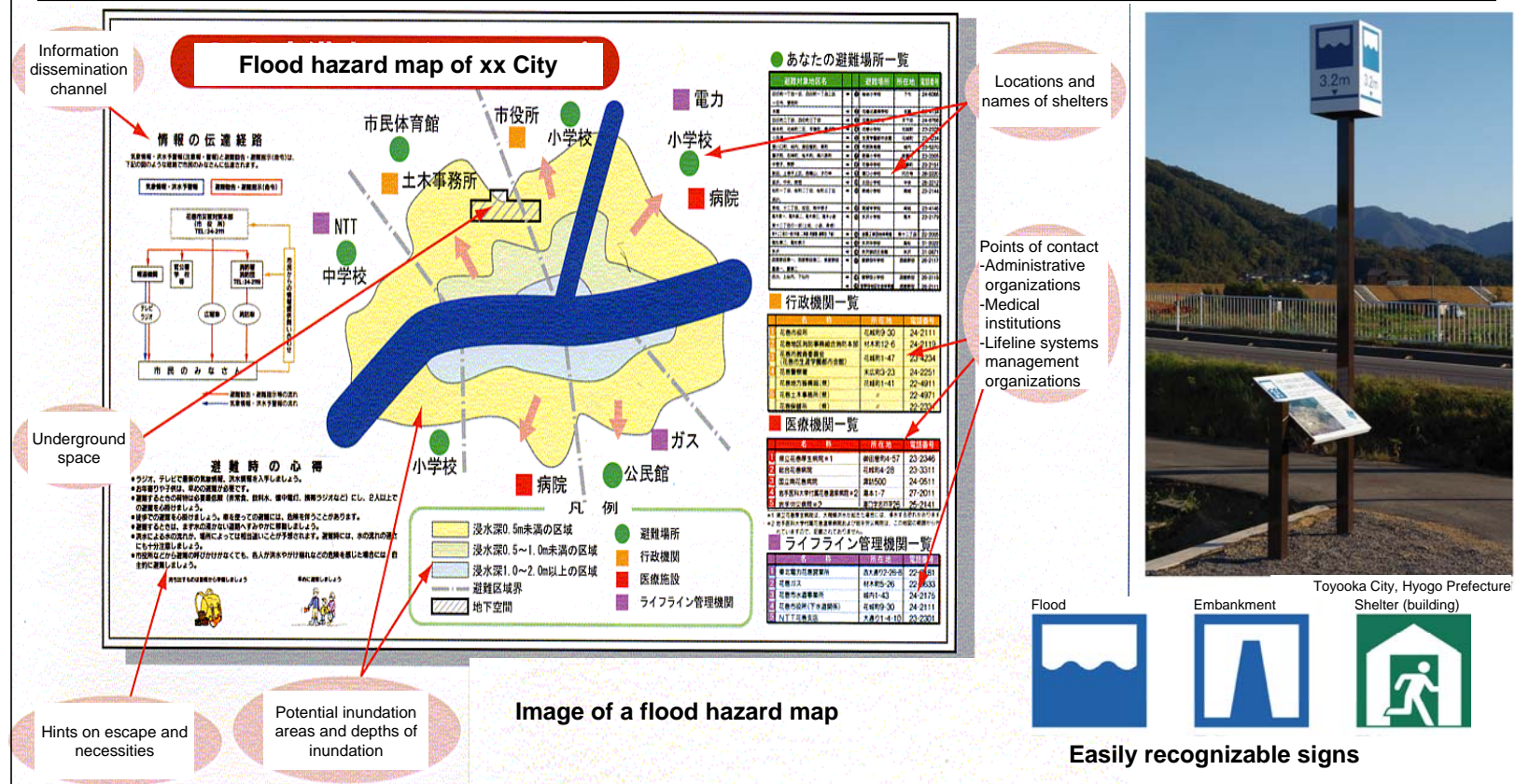
- Investigation of damage
- Quick repairing
- Prediction of degree of damage risk
- Planning of control measures
- High-level technical guidance
- Assistance in reconstruction



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Share preliminary information concerning the degree of flood risk

Flood hazard map of xx City



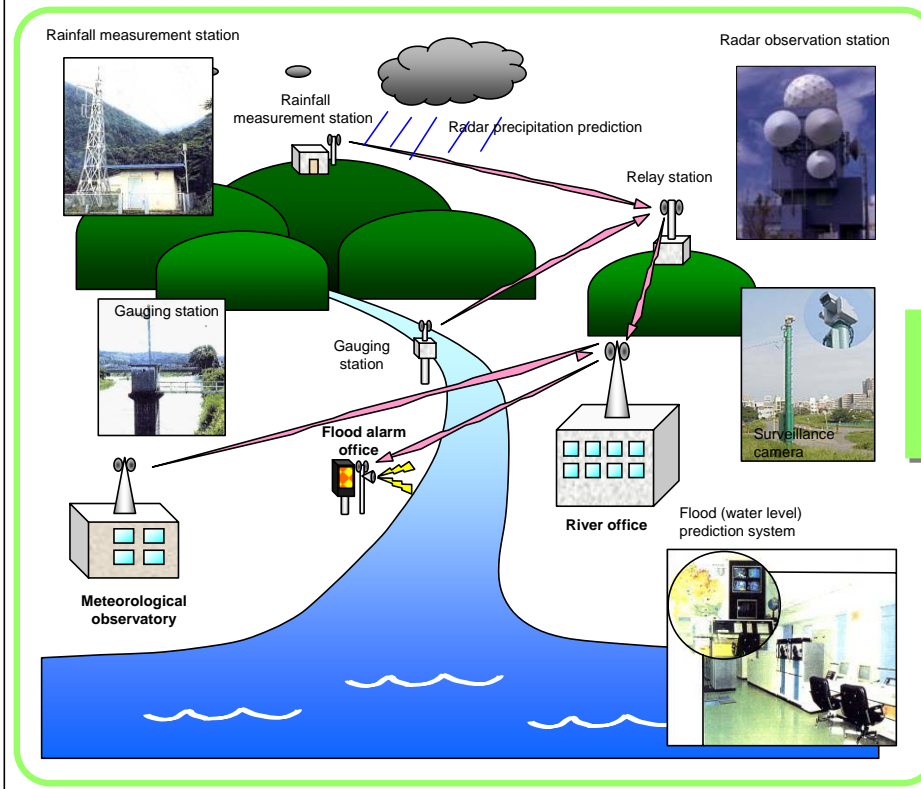
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Adaptation measures based on risk management

Share real-time information

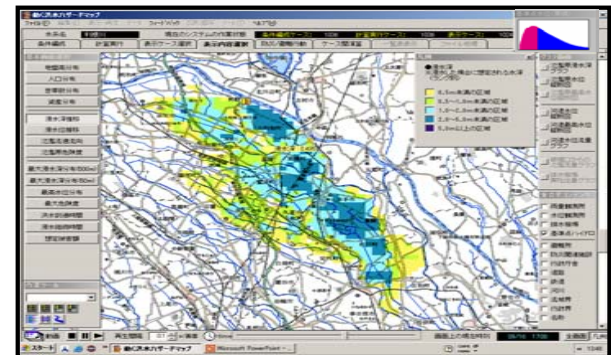
- Provision of rainfall amounts and water levels real-time via cellular phone, the Internet or local disaster prevention radio
- Flood forecasting through real-time simulation



Information provision via cellular phone or personal computer



Delivery of an image to a TV screen



Floodwater prediction through real-time simulation

- (1) Inter-governmental efforts**
- (2) Promotion of cooperative work with the public**
- (3) Priority investment in preventive measures**
- (4) Clear prioritization**
- (5) Preparation of road maps**
- (6) Adoption of a flexible approach**
- (7) Cooperation with related organizations**
- (8) Developing new technologies and contributing to the international community**
- (9) Promotion of research and application of their results to plan flood control, water use, and environmental conservation**

Future timeline for implementation of this study

6. Japan's response to climate change

Revising adaptation measures by analysis of water-related disaster risks with improvement of flood prediction by monitoring changes of climate change and social condition.

