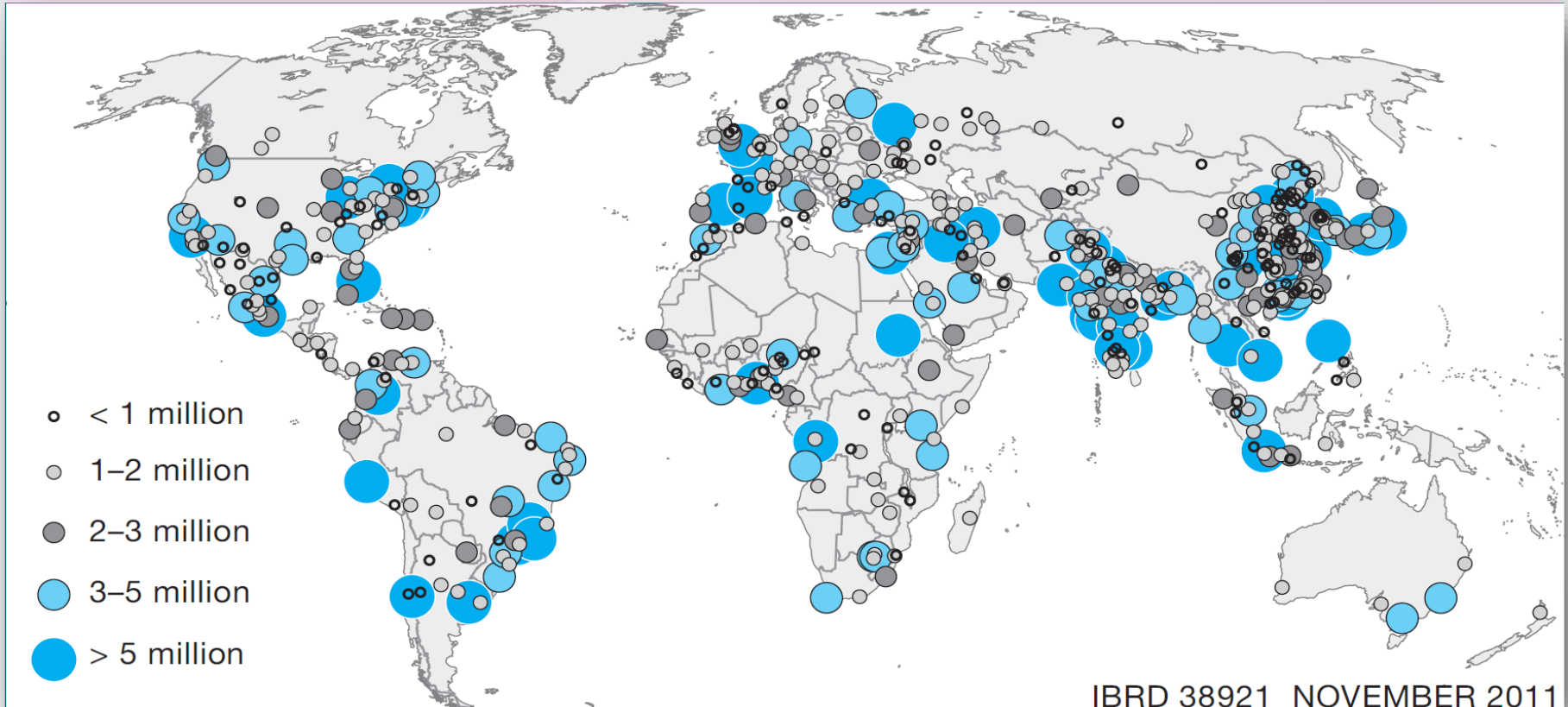


Comprehensive Risk Management of Urban Flood -- Flood Damage Control Law for Specified Urban River Basins --

Dr. Hitoshi BABA

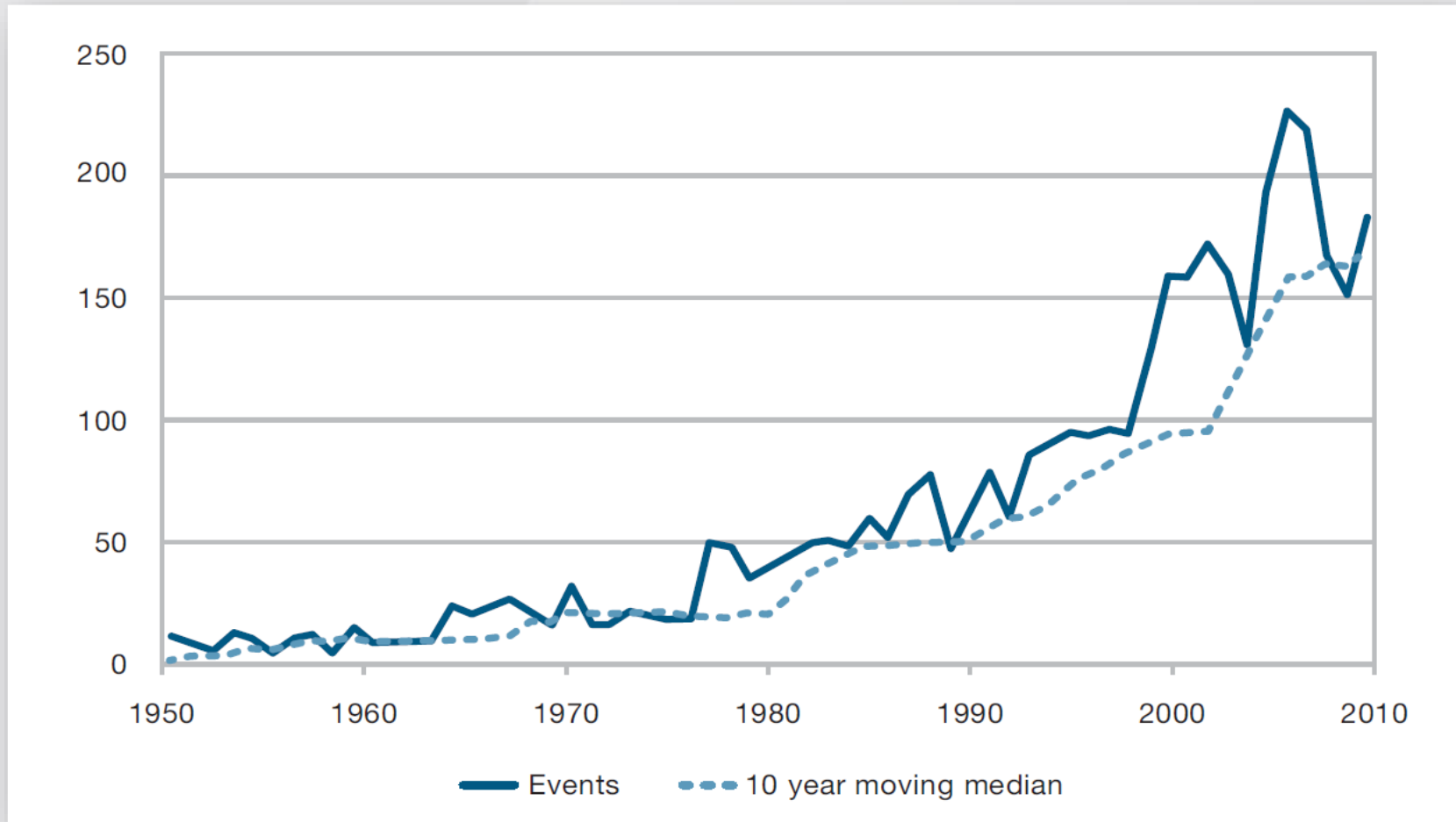
Ph.D. Environment and Resource Engineering
Senior Advisor, Japan International Cooperation Agency
email: Baba.Hitoshi@jica.go.jp

Urban agglomerations with more than 750,000 inhabitants, 2010.



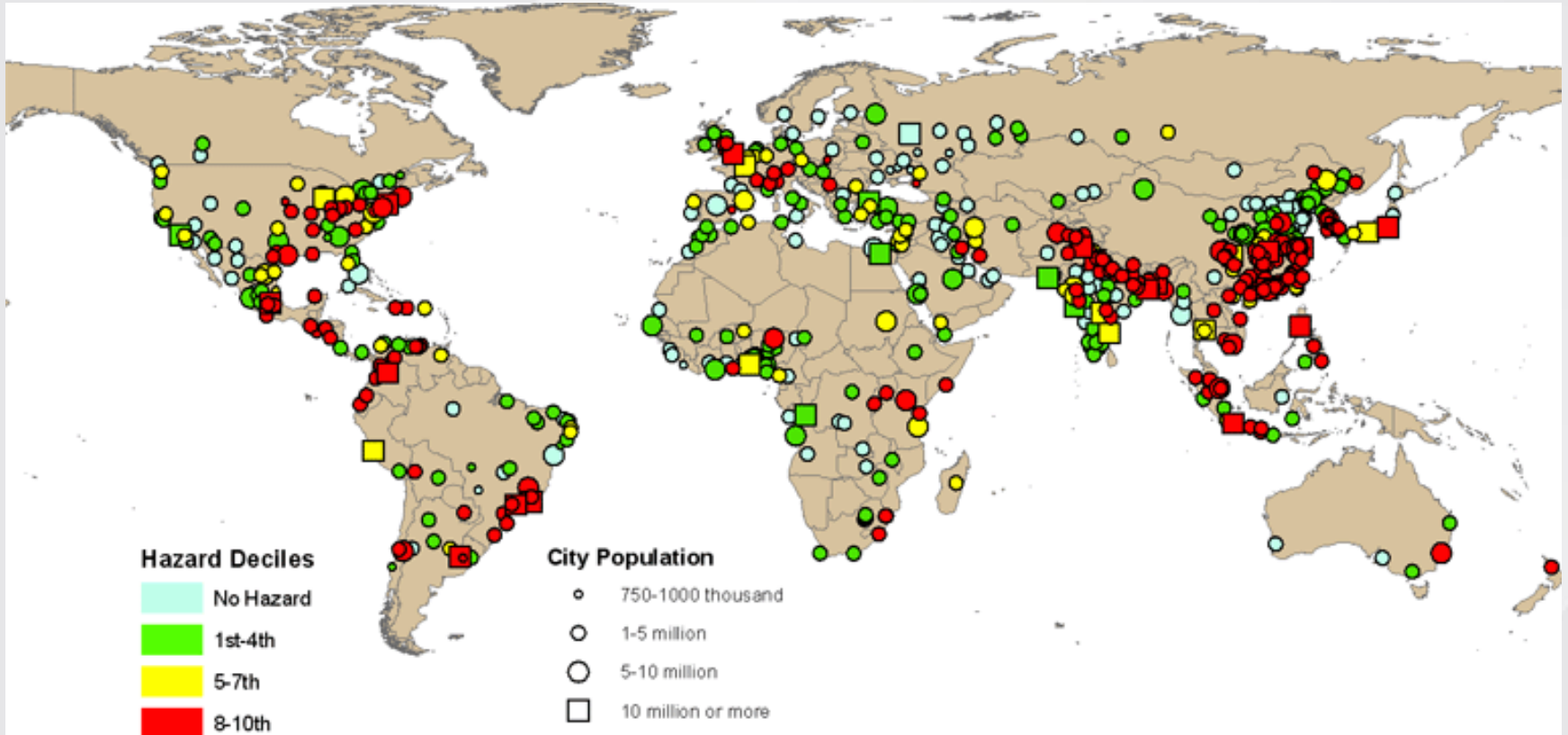
Source: United Nations, Department of Economic and Social Affairs, Population Division; World Urbanization Prospects: The 2009 Revision; File 12: Population of Urban Agglomerations with 750,000 Inhabitants or More in 20 Urban agglomerations with more than 750,000 inhabitants, 2010.

Number of reported flood events.



Source: based on EM-DAT/CRED

Urban agglomerations by size and potential risk of flooding, 2025 prospect



Source: World Urbanization Prospects, the 2011 Revision

Increasing urban flood risk

- Recently increasing urban risk



Eigenbrod, F., Bell, V.A., Davies, H.N., Heinemeyer, A., Armsworth, P.R., and Gaston, K.J. 2011. The impact of projected increases in urbanization on ecosystem services. *Proceedings of the Royal Society B: Biological Sciences*, online advance publication.

Lessons from experience

Japan's most rapid development after the WW2

1945

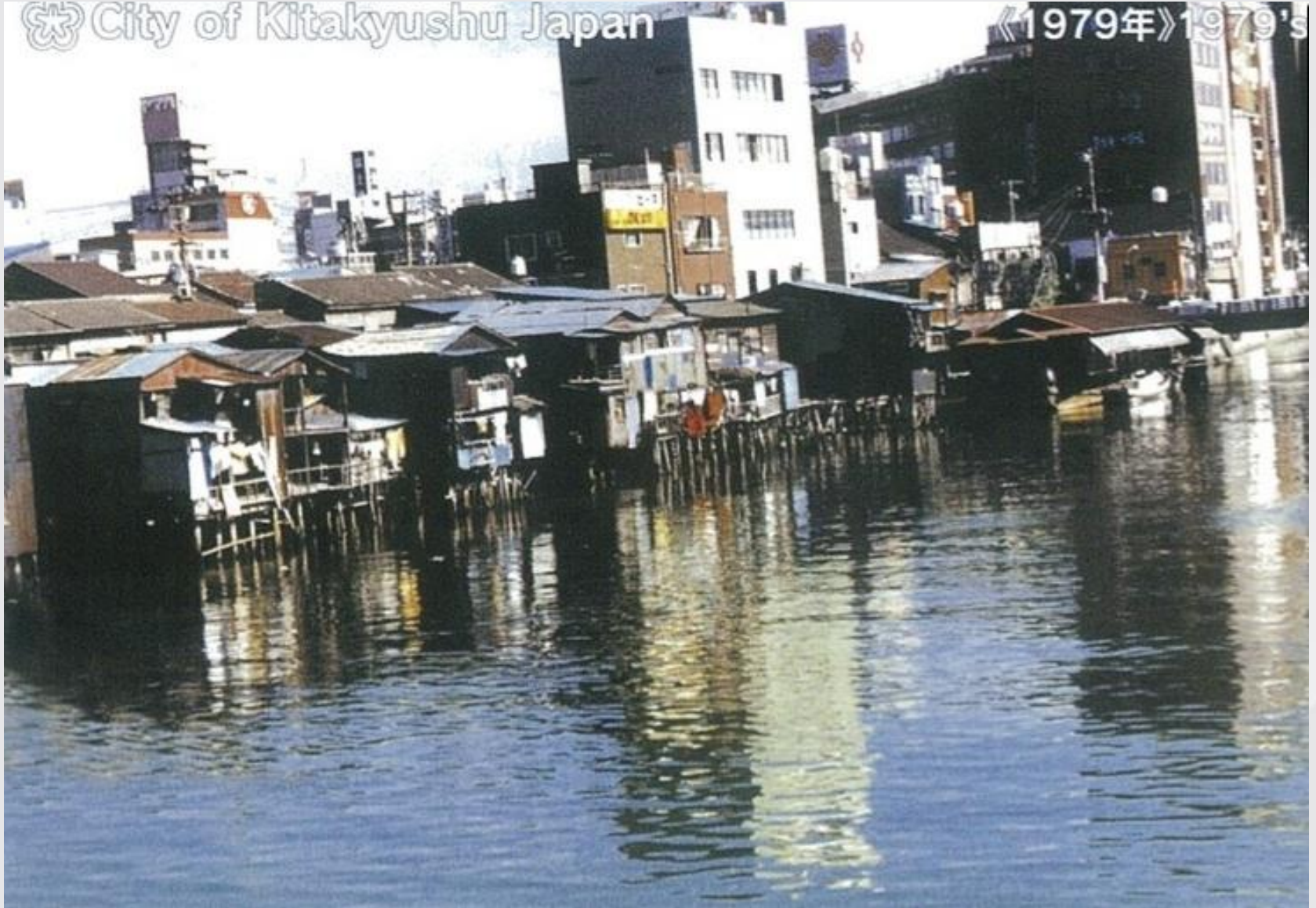


2004



City of Kitakyushu Japan

《1979年》1979's

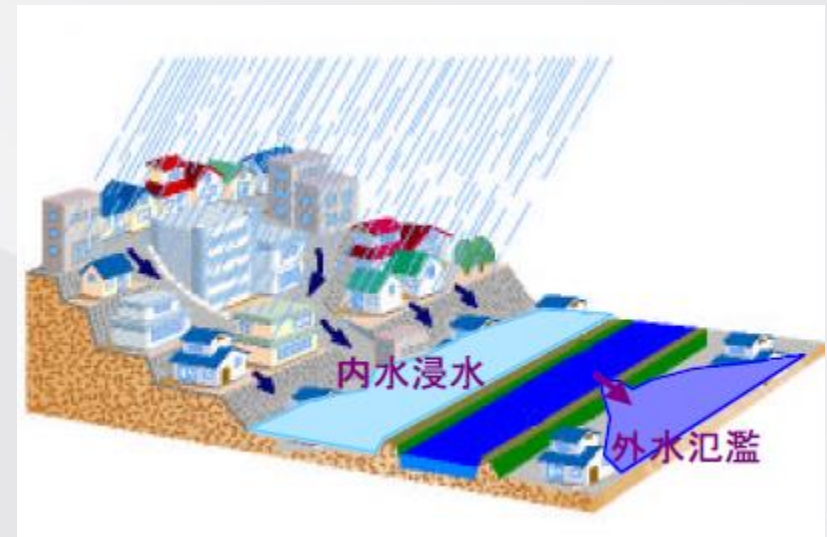


City of Kitakyushu Japan

《現在》recovered river



Uncontrolled watershed development,
hampered infiltration and accelerated surface
flow could cause flashy and heavy flooding



Increasing inundation disaster
in urban river basins

Good practice of urban flood risk management in Tsurumi River, Kanagara



Consideration for

- Recently increasing urban risk
- Importance of risk reduction to secure the future sustainable development



1976 Flood in Yokohama (Tokyo Metropolitan Area)





normally

The image shows a large reservoir with a concrete dam in the background. The water level is low, and the surrounding area is green and well-maintained. There are several tennis courts in the foreground, and a building is visible on the right side of the reservoir. The sky is clear and blue.

Kirigaoka reservoirs
(Tsurumi river)

Controlled flooding



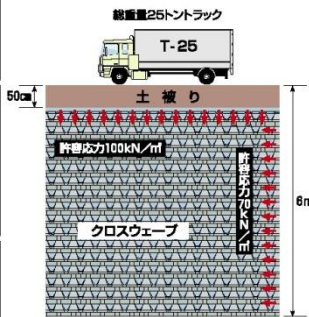
flooded

The image shows the same reservoir as in the 'normally' state, but now it is completely flooded. The water is murky brown, and the surrounding area is submerged. The tennis courts and building are now underwater. The sky is overcast and grey.

Underground Flood Water Storage



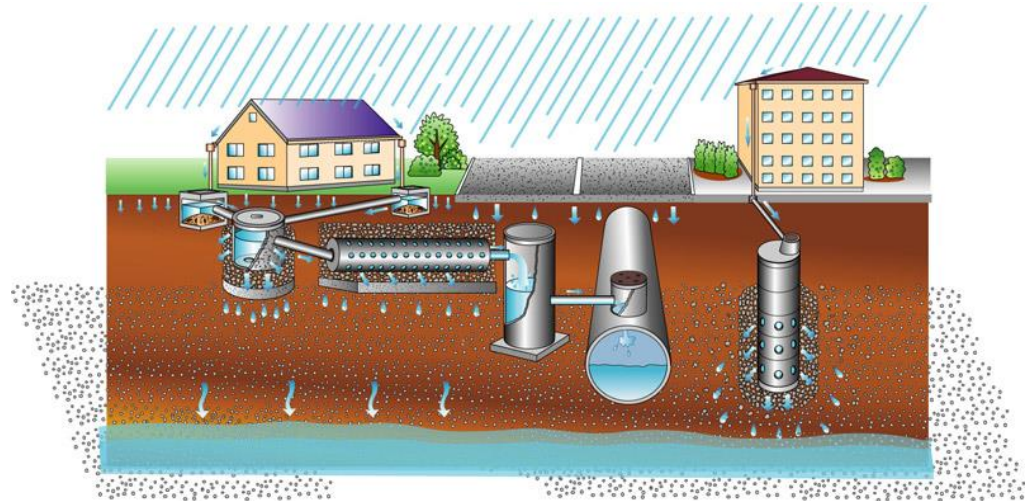
施工中



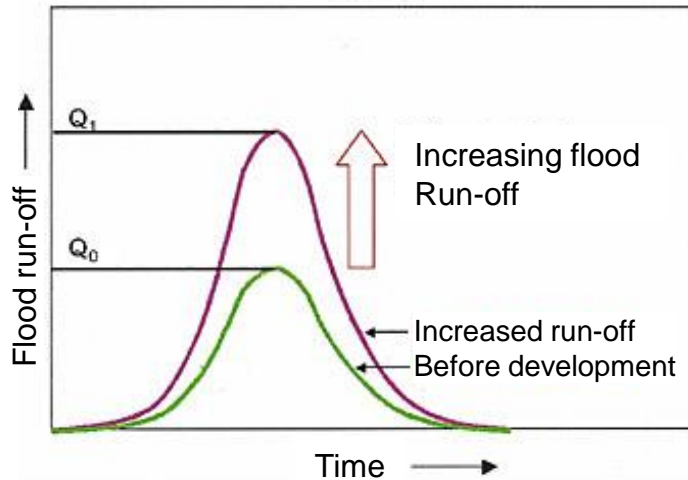
high void ratio : 90%+



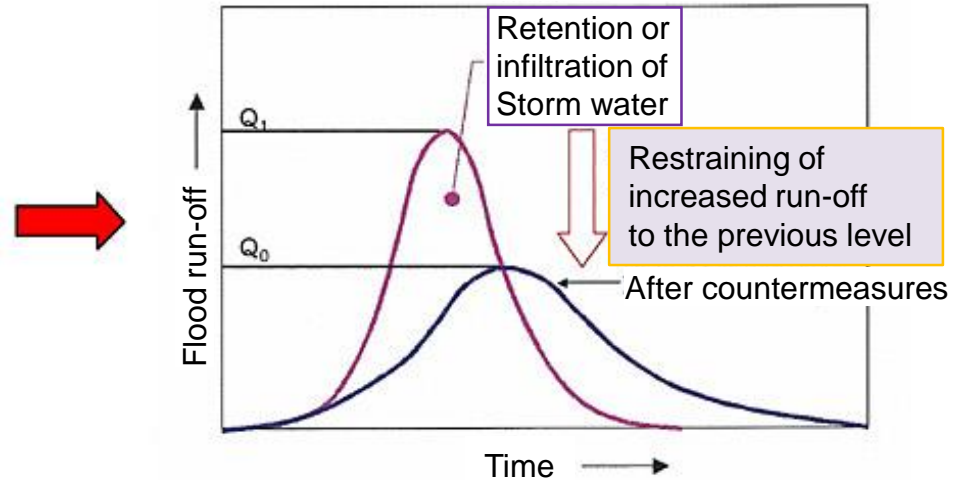
完成後



Without flood retention measure



Function of Countermeasures



Dam, Tunnel and High Standard Structures

Flood Control Dam



Underground Flood Tunnel



High Standard Embankment

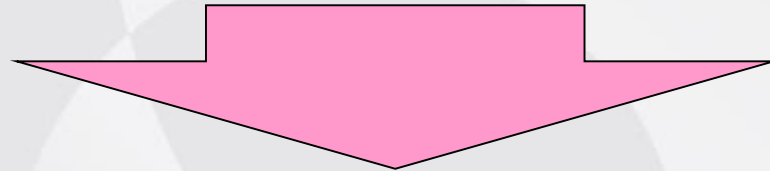


Comprehensive measures of flood control

	By Strategies of Flood Control	In-stream	Watershed	Information
Prevention and Mitigation	<u>Preserving the Natural Resources of Flood Plains</u>			
	Floodplain zoning and land use regulation		✓	
	<u>Reducing Flooding</u>			
	Dams and reservoirs	✓		
	Dikes, levees and polders	✓		
	High flow diversions, cut-off works	✓	✓	
	Catchment management		✓	
	Channel improvements	✓		
	<u>Reducing Susceptibility to Damage</u>			
	Floodplain regulation, storm water retention			✓
Surface water infiltration			✓	
Design and location of facilities			✓	
Housing and building codes			✓	
Flood proofing buildings and facilities			✓	
Preparedness and Response	Flood forecasting and warning			✓
	<u>Mitigating the Impacts of Flooding</u>			
	Information and education			✓
	Disaster preparedness	✓	✓	✓
Food fighting, evacuation and rescue	✓	✓	✓	
Rehabilitation and Reconstruction	Post-flood recovery and reconstruction	✓	✓	
	Flood insurance			✓

National level coordination needed

- Needs to get participated by government and private entity of watershed
- Needs to apply technical standard
- Needs to make flood control measures obligated



A new scheme is required to effectively implement flood control measures against increasing inundation disaster in urban river basins.

→ Measures through cooperative efforts of river administrator, sewerage system administrator, local municipalities etc.

“Flood Damage Control Law for Urban River Basins in Japan”



Inundation during the Tokai
heavy rains of 2000

- Frequent flood damages in urban areas due to the Tokai flood of 2000 and recent disasters
- Frequent local heavy rains and increase of inundation hazard due to urban development

Previous Laws and frameworks of urban flood issues

River Law

Flood disaster prevention by structural means of Stream Channel Improvement, Dams and Embankments in the area stipulated as 'river'

Flood Protection Law

Emergency flood response by non-structural means of flood forecasting, alert on potential inundation areas and flood fighting operations

Sewerage Service Law

Inland Rainwater treatment by means of sewerage and drainage systems, only in small capacity for maintaining facilities

City Planning Law

Permission of development, only at the inception stage

New framework of Urban Flood Control (UFC)

River Law

Flood disaster prevention by structural means of river channel improvement, Dams and Embankments in the 'river'

Flood Protection Law

Emergency flood response by non-structural means of flood forecasting, alert on potential inundation areas and flood fighting operations

Flood Damage Control Law for Specified Urban River Basins

(Law No.77, 2003)

- Spatial distribution of measures that cross over the conventional Laws
- Obligatory installation of flood control facilities
- Obligatory reporting of actions and operations
- Administrative agreement among local public organizations
- Cost sharing rules

Sewerage Law

Inland Rainwater treatment by means of sewerage and drainage systems, only in small capacity for maintaining facilities

City Planning Law

Permission of development, only at the inception stage

Major features of the UFC Law

- Article 3 Designation of the specified urban river and river area
 - Article 4 Formation of the plan for flood damage control measures in the river-basin
 - Article 6 Development / maintenance of facilities for retention and infiltration of storm water by 'river administrator'
 - Article 7 Defrayment (cost sharing) by other local authorities
 - Article 8 Special technical standard on drainage facilities
- (Restrictions, etc. in the catchments area)
- Article 9-22 A Permit, etc. for an action to hamper infiltration of storm water
 - Article 23-26 Conservation of Regulation pond
 - Article 27-31 Management agreement

Major features of the Law

Article 3 Designation of the Specified Urban River, etc.

.....the 'specified urban river' and the 'catchments area of the specified urban river'

.....Minister or Governor can designate if any river is in condition that **river water flows through the urban area, of which river basin, an extensive flood damage happens or is feared to happen, however, it is hard to take flood damages prevention measures such as stream channel arranging with sufficient capacity or flood control dam due to progress of urbanization;**

Major features of the Law

Article 3 Designation of the specified urban river

Article 4 Formation of the plan for flood damage control measures in the river-basin

Article 6 Development / maintenance of facilities for retention and infiltration of storm water by 'river administrator'

Article 7 Defrayment by other local authorities

Article 8 Special technical standard on drainage facilities

(Restrictions, etc. in the catchments area)

Article 9-22 A Permit, etc. for an action to hamper infiltration of storm water

Article 23-26 Conservation of Regulation pond

Article 27-31 Management agreement

Major features of the Law

Article 4 Formation of the plan for flood damage control measures in the river-basin

- 1) **Basic policy**
- 2) **Target Amount of rainfall**
- 3) **Maintenance**
- 4) **Development / maintenance of the facilities for retention and infiltration by the administrator**
- 5) **Development / maintenance of the urban sewerage system**
- 6) **Temporary retention and infiltration by the ones other than the river administrator and the sewerage administrator**
- 7) **Operation of the pumps**
- 8) **Prevention of damage**
- 9) **Besides what are provided in the preceding clauses, matters related to measures needed for prevention of the flood damage.**

Major features of the Law

- Article 3 Designation of the specified urban river
 - Article 4 Formation of the plan for flood damage control measures in the river-basin
 - Article 6 Development / maintenance of facilities for retention and infiltration of storm water by 'river administrator'**
 - Article 7 Defrayment by other local authorities
 - Article 8 Special technical standard on drainage facilities
- (Restrictions, etc. in the catchments area)
- Article 9-22 A Permit, etc. for an action to hamper infiltration of storm water
 - Article 23-26 Conservation of Regulation pond
 - Article 27-31 Management agreement

Major features of the Law

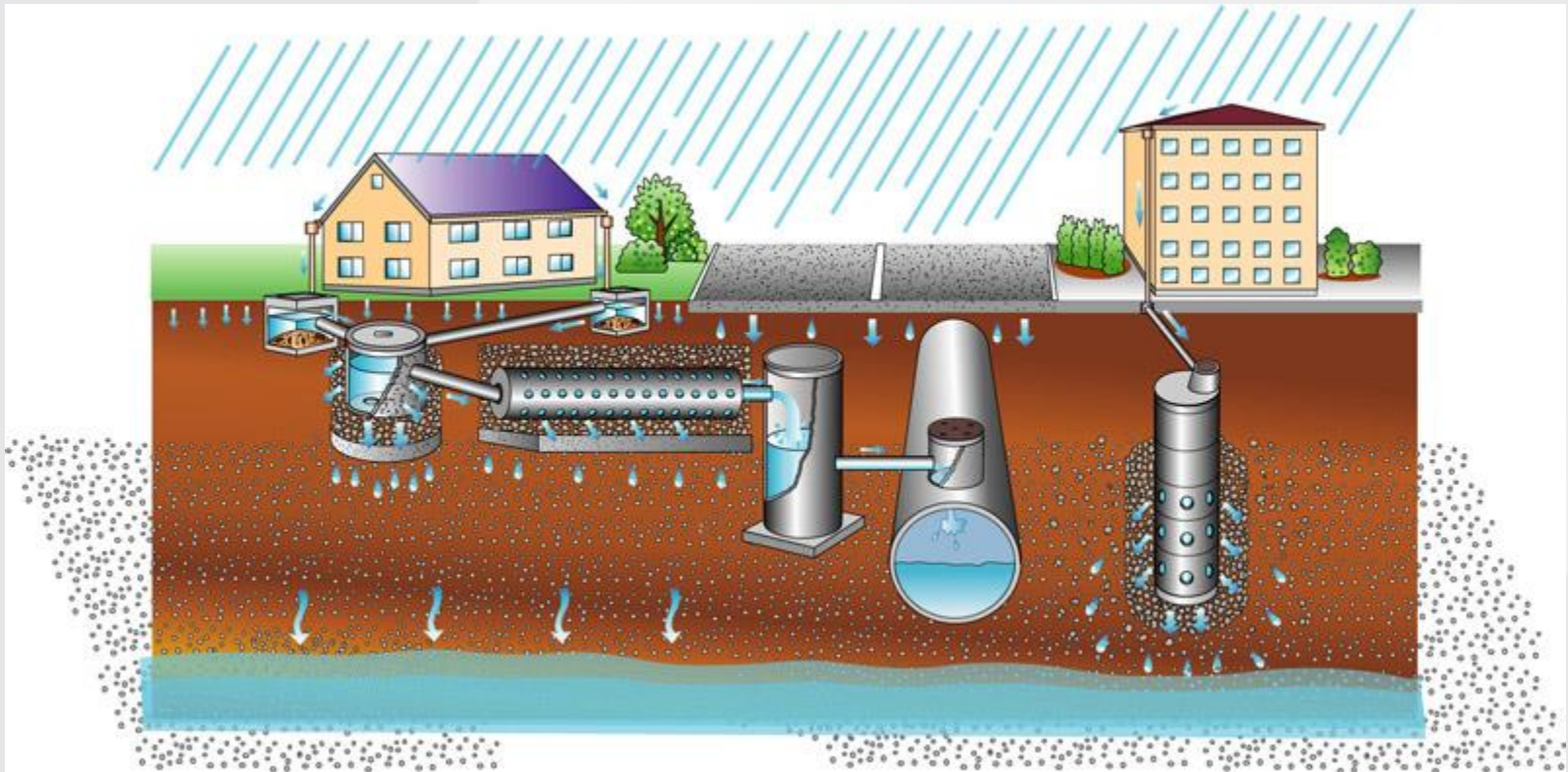
Article 6 Development / maintenance of facilities for retention and infiltration of storm water by 'river administrator'

Storage and infiltration facility in the basin



Major features of the Law

Article 6 Development / maintenance of facilities for retention and infiltration of storm water by 'river administrator'



Major features of the Law

- Article 3 Designation of the specified urban river
 - Article 4 Formation of the plan for flood damage control measures in the river-basin
 - Article 6 Development / maintenance of facilities for retention and infiltration of storm water by 'river administrator'
 - Article 7 Defrayment (cost sharing) by other local authorities**
 - Article 8 Special technical standard on drainage facilities
- (Restrictions, etc. in the catchments area)
- Article 9-22 A Permit, etc. for an action to hamper infiltration of storm water
 - Article 23-26 Conservation of Regulation pond
 - Article 27-31 Management agreement

Major features of the Law

- Article 3 Designation of the specified urban river
- Article 4 Formation of the plan for flood damage control measures in the river-basin
- Article 6 Development / maintenance of facilities for retention and infiltration of storm water by 'river administrator'
- Article 7 Defrayment by other local authorities
- Article 8 Special technical standard on drainage facilities**

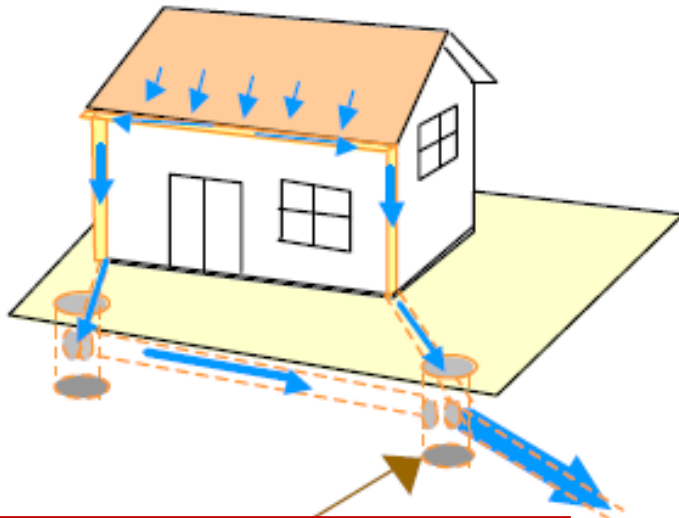
(Restrictions, etc. in the catchments area)

- Article 9-22 A Permit, etc. for an action to hamper infiltration of storm water
- Article 23-26 Conservation of Regulation pond
- Article 27-31 Management agreement

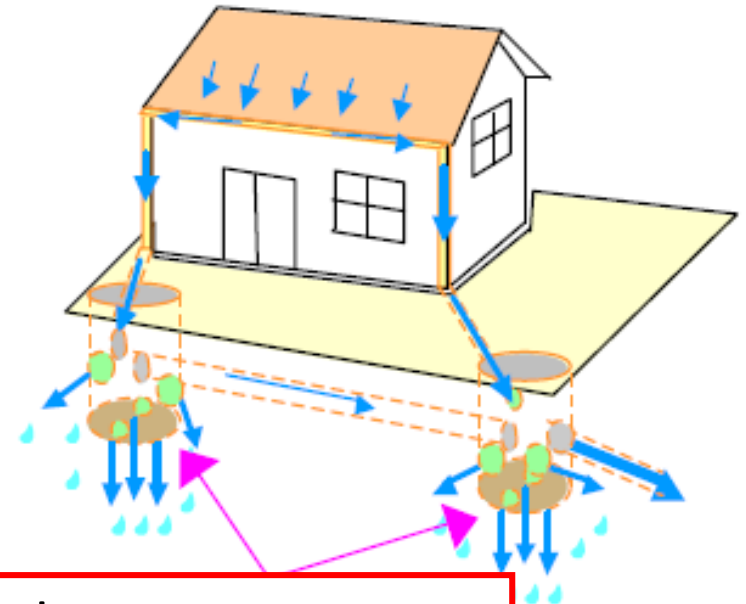
Major features of the Law

Article 8 Special technical standard on drainage facilities

Example; Infiltration in each private house



Regular storm sewer



Improved storm sewer
with Infiltration function

Major features of the Law

- Article 3 Designation of the specified urban river
- Article 4 Formation of the plan for flood damage control measures in the river-basin
- Article 6 Development / maintenance of facilities for retention and infiltration of storm water by 'river administrator'
- Article 7 Defrayment by other local authorities
- Article 8 Special technical standard on drainage facilities

(Restrictions, etc. in the catchments area)

Article 9-22 A Permit, etc. for an action to hamper infiltration of storm water

Article 23-26 Conservation of Regulation pond

Article 27-31 Management agreement

Major features of the Law

Article 9-22 A Permit, etc. for an action to hamper infiltration of storm water

1. Change of land use to housing area, etc.



Arable land



Housings



2. Pavement



Arable land



Parking's



3. Land development with drainage facility



Forest



Play ground



4. Change of land use with surface compaction

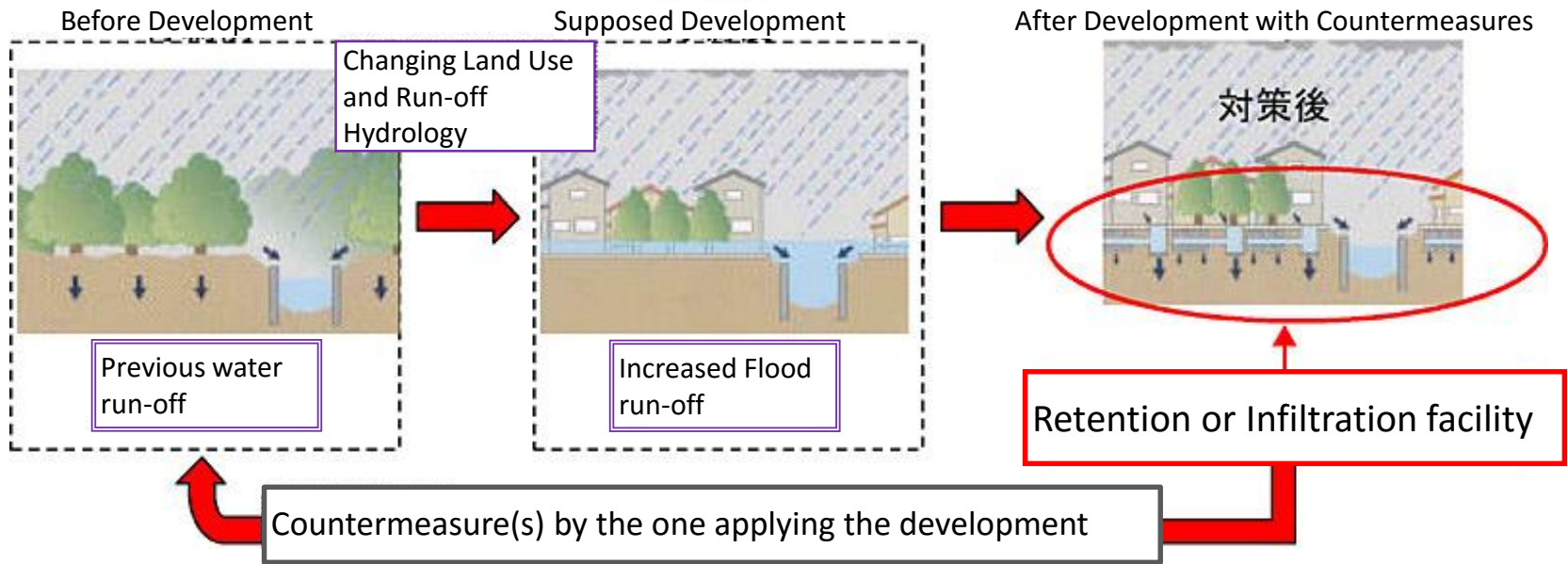
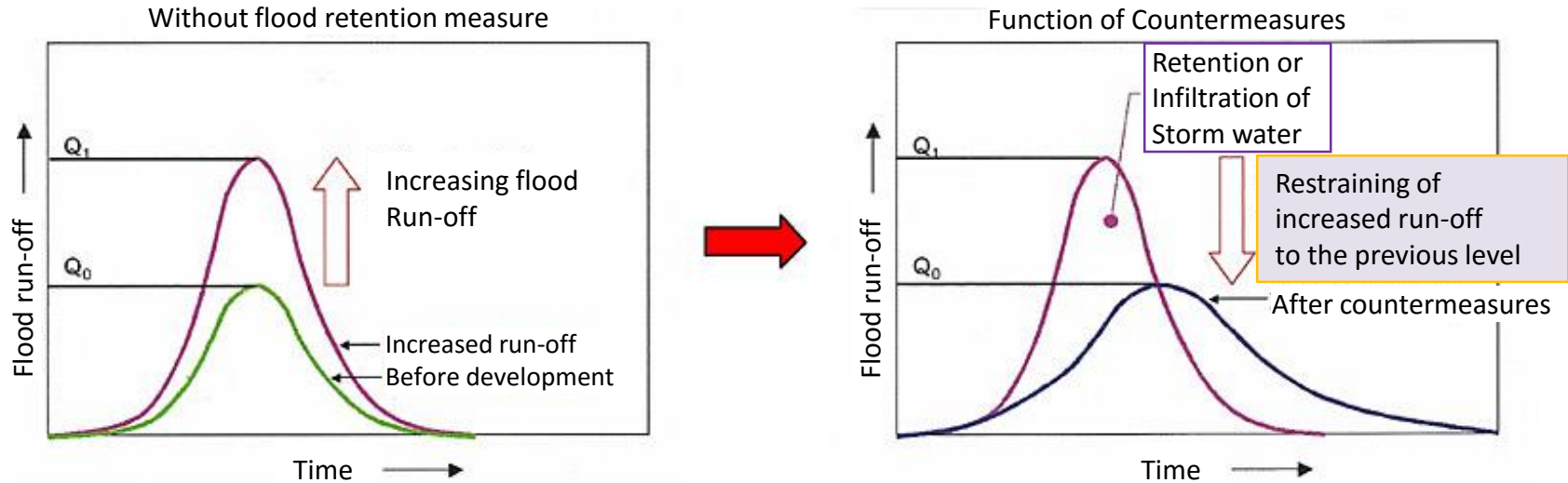


Wilderness



Stock yard





Each developer has to restrain the increasing run-off to the level Before Development

Examples of the technical standard, stipulated in the cabinet order

Change of land use to housing area



Needs Flood Regulation Pond with more than **480m³/ha**

Change of land use with surface compaction



Needs Flood Regulation Pond with more than **190m³/ha**



A Flood Regulation Pond

Major features of the Law

- Article 3 Designation of the specified urban river
 - Article 4 Formation of the plan for flood damage control measures in the river-basin
 - Article 6 Development / maintenance of facilities for retention and infiltration of storm water by 'river administrator'
 - Article 7 Defrayment by other local authorities
 - Article 8 Special case related to technical standard on drainage facilities
- (Restrictions, etc. in the catchments area)
- Article 9-22 A Permit, etc. for an action to hamper infiltration of storm water
 - Article 23-26 Conservation of Regulation pond**
 - Article 27-31 Management agreement

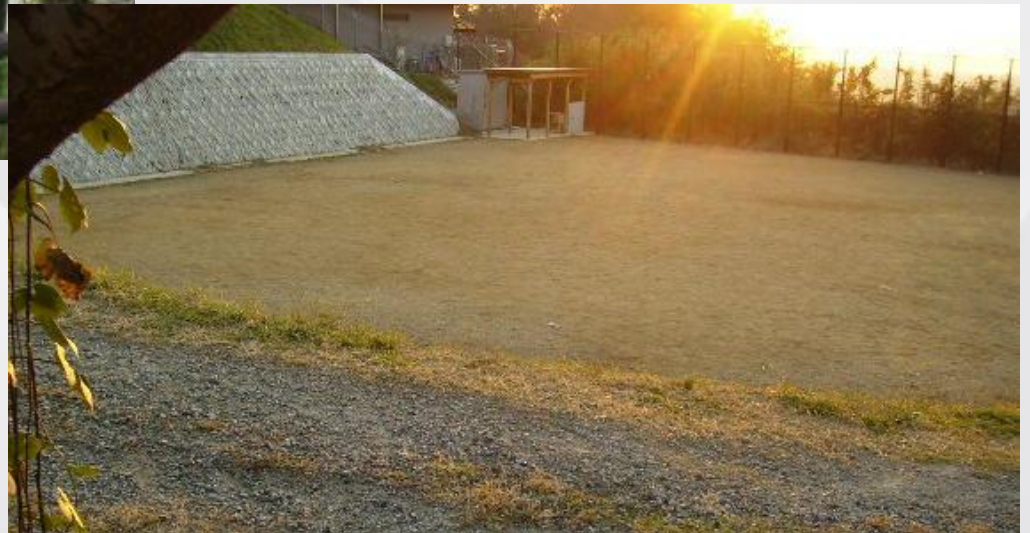
Major features of the Law

Article 23-26 Conservation of Regulation pond



“Conservative Regulation Pond”

Reclaimed space,
loosing the Function
of flood retention



Major features of the Law

- Article 3 Designation of the specified urban river
- Article 4 Formation of the plan for flood damage control measures in the river-basin
- Article 6 Development / maintenance of facilities for retention and infiltration of storm water by 'river administrator'
- Article 7 Defrayment by other local authorities
- Article 8 Special case related to technical standard on drainage facilities

(Restrictions, etc. in the catchments area)

Article 9-22 A Permit, etc. for an action to hamper infiltration of storm water

Article 23-26 Conservation of Regulation pond

Article 27-31 Management agreement