

River Basin Management in Japan

-Flood Control Measures, Water Resources Management-

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History of the River Act

1896

Birth of modern river management system

Flood management

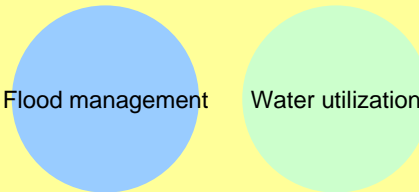


1964

Establishment of systems for systematic flood management and water utilization

- Introduction of integrated management system for river systems
- Establishment of water utilization rules and regulations

Flood management + Water utilization



1997

Establishment of integrated river management system for flood management, water utilization and environmental conservation

- Improvement and conservation of river environment
- Introduction of a system for river planning reflecting the opinions of local community

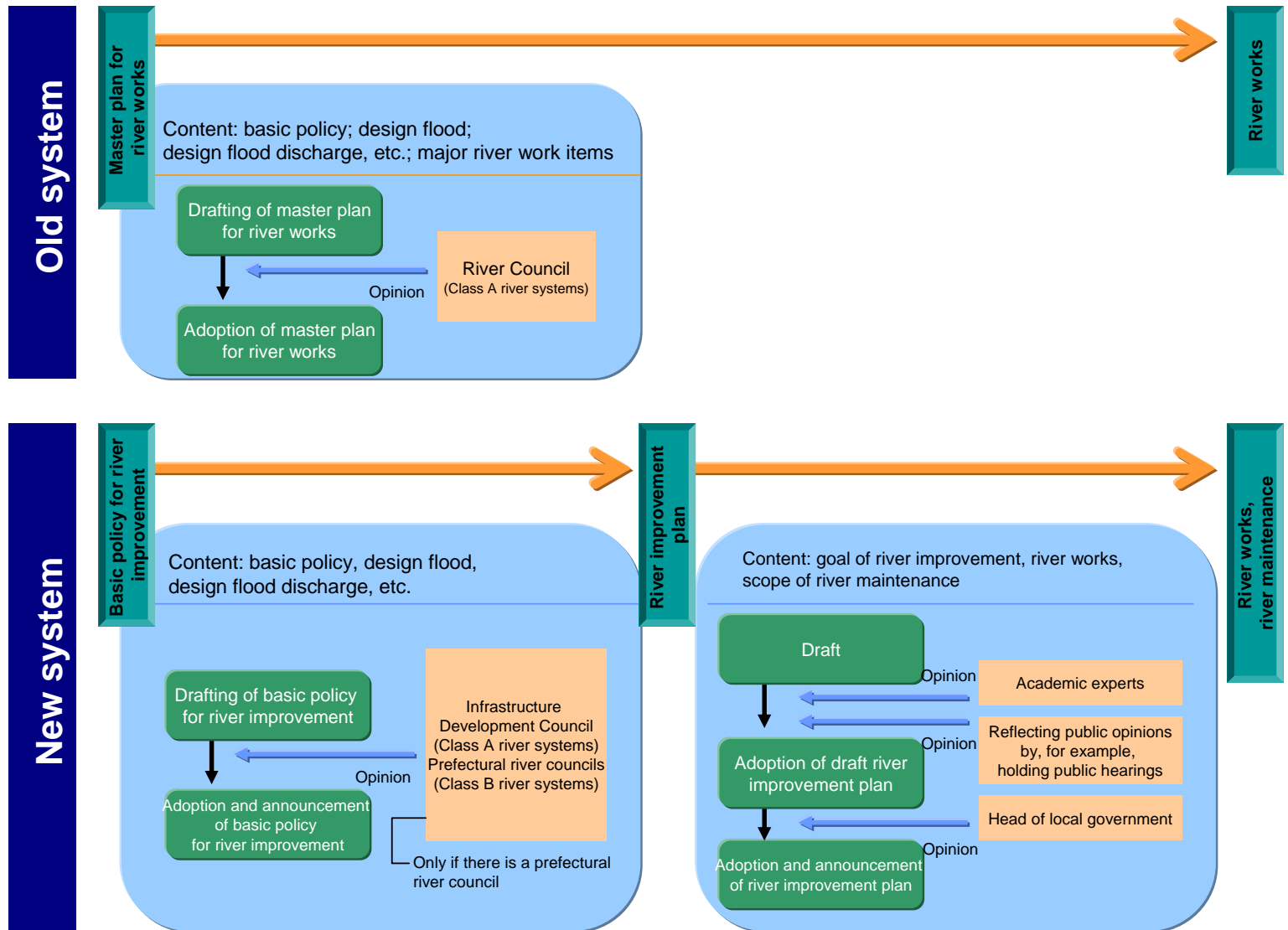
Flood management

Water utilization

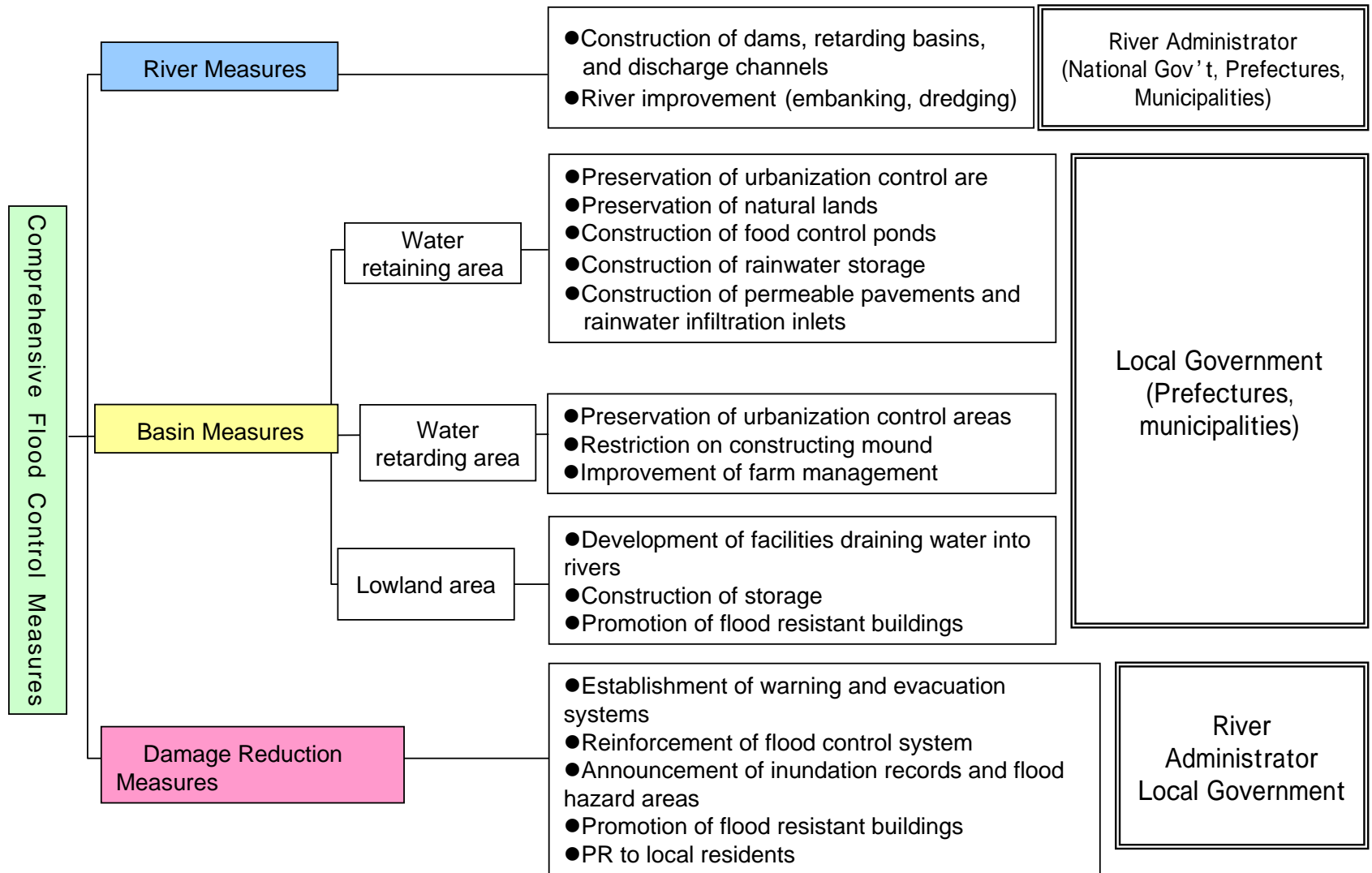
Environment



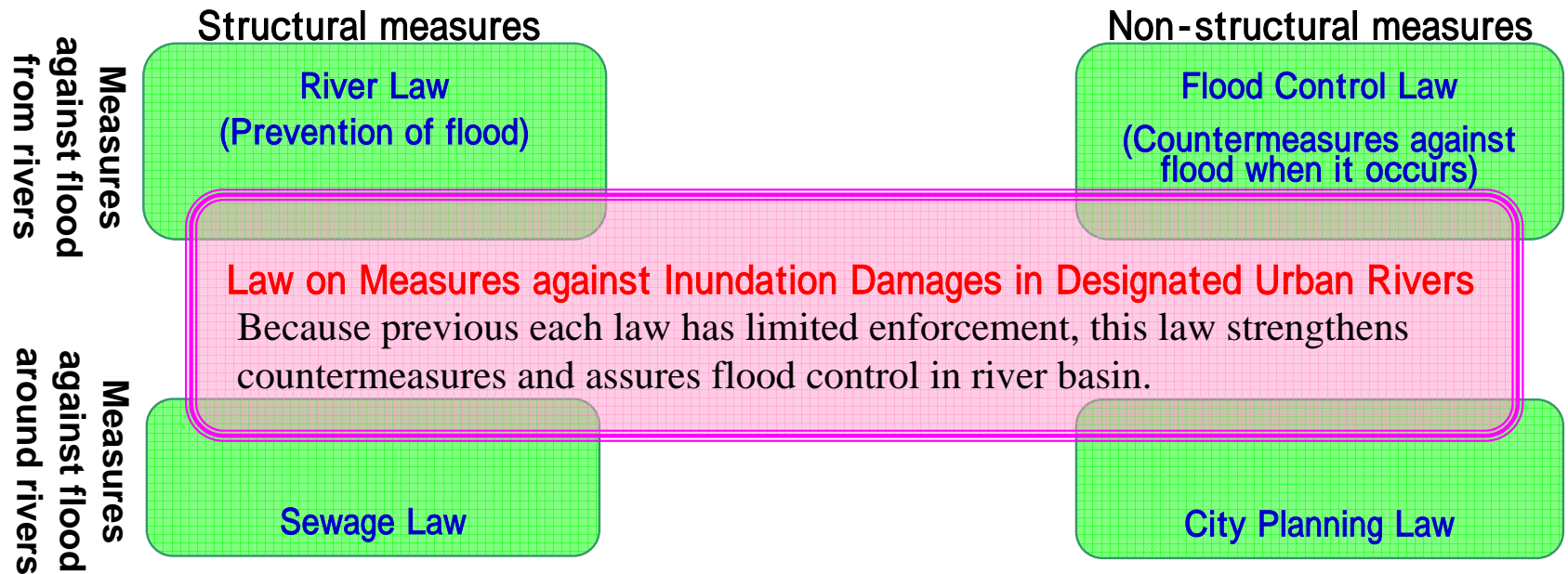
Transition from the old system to the new system due to the River Law amendment



System of Comprehensive Flood Control Measures



Outline of Law on Measures against Inundation Damages in Designated Urban Rivers



Designate urban river (basin)

- Urban area covers more than 50% of river basin
- Average annual damage (occurred or predicted) exceeds 1 billion yen (=\$10mil)
- Because of urbanization, it is difficult to control flood by constructing river facilities or flood control dams

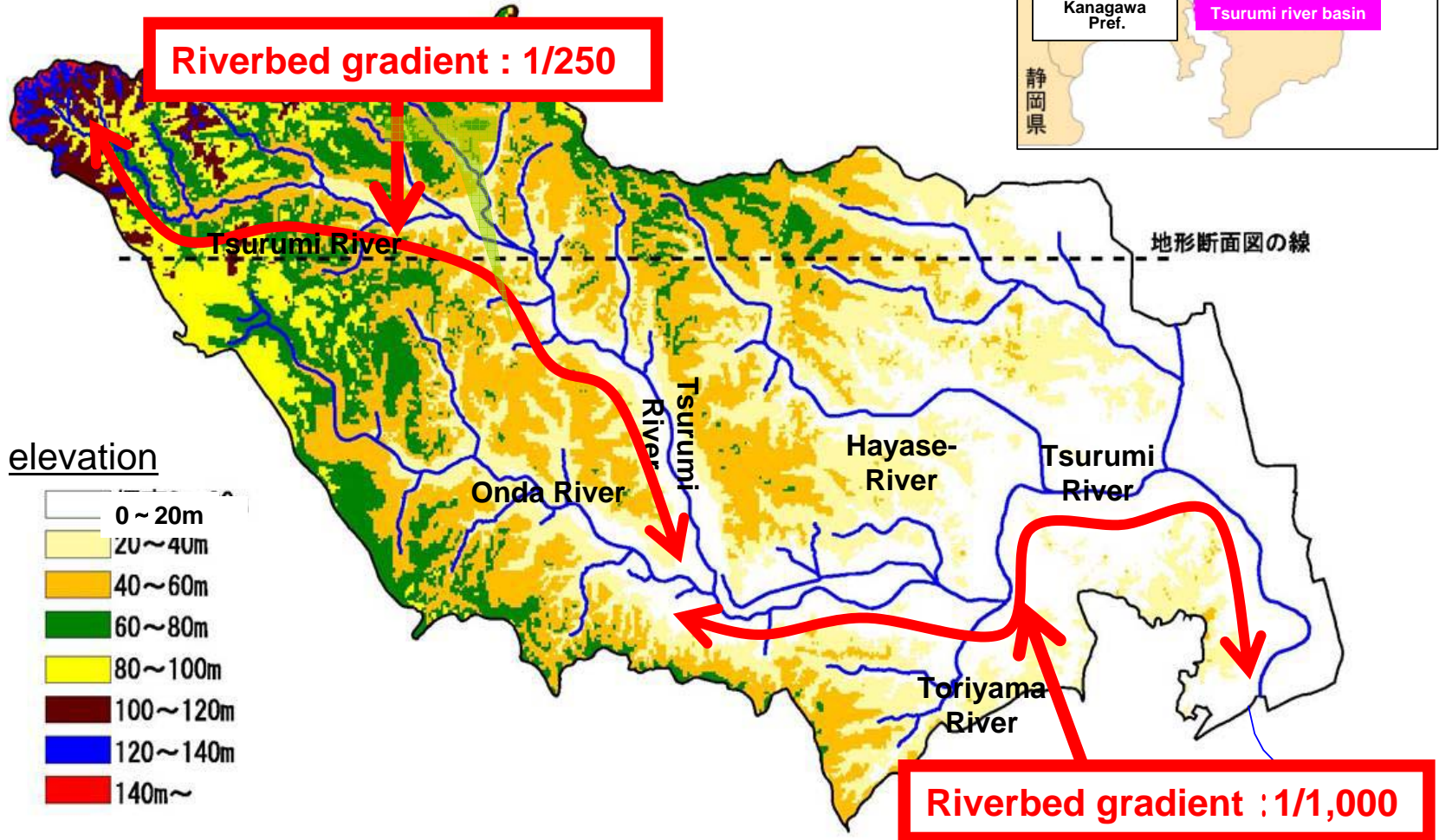
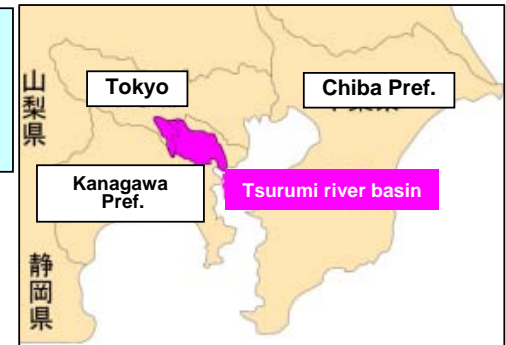
Formulate river basin flood control plan

- 4 members (river and sewage administrators, governors, and mayors) make the plan together

Implementation of measures

Outline of Tsurumi River (Geography)

River basin area 235km² Hill / tableland 70%
Main stream length 42.5km Alluvial lowland 30%



Outline of Tsurumi River (Urbanization and population increase)

Urbanization ration has increased
by **75%** in 50years

Rapid economic growth has turned
natural area into urban area

1958 10%

450,000

1966 20%

700,000

1975 60%

1,200,000

Present 85%

1,880,000

Urbanization

Population

Natural Area

Urban Area

Typhoon Karinogawa in Sep 1958



Typhoon No.17 in Sep 1976



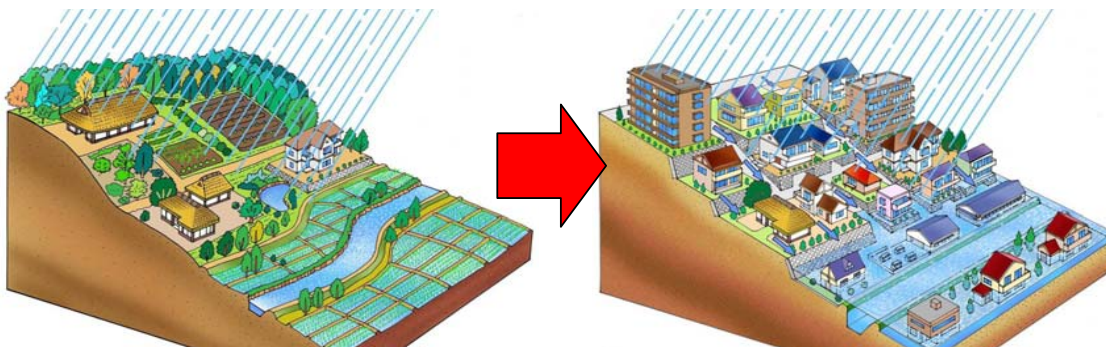
Outline of Tsurumi River (Effect of urbanization)

- Population increased by 1.4 million in 50 years
- 85% of river basin area urbanized
- Typical urban river

As a result

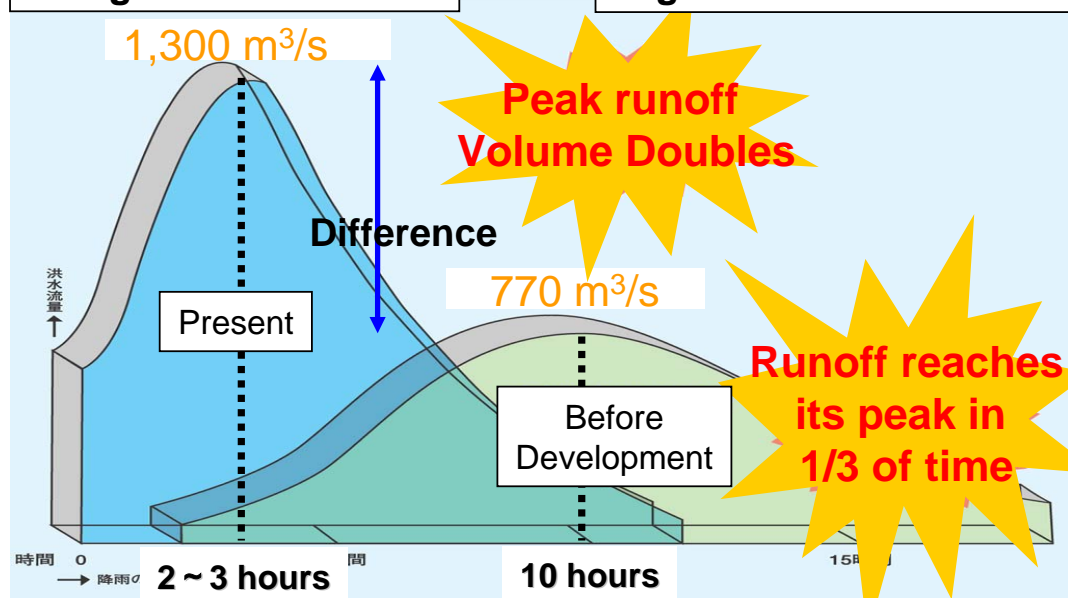
- Discharge into river has become faster
- Peak runoff has become bigger

Function of keeping and retarding water became weakened



Before development
Slight urbanization

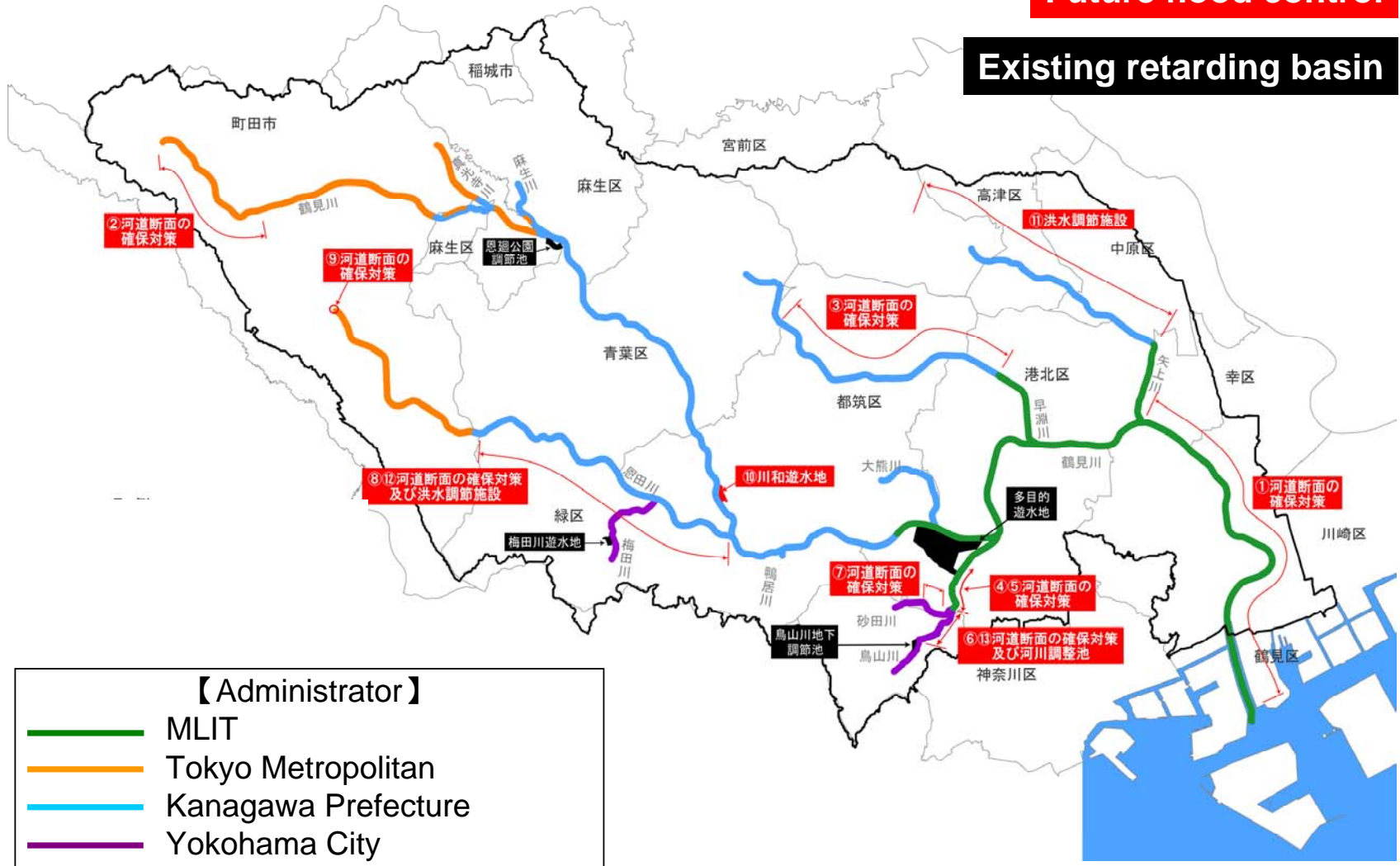
After development
Significant urbanization



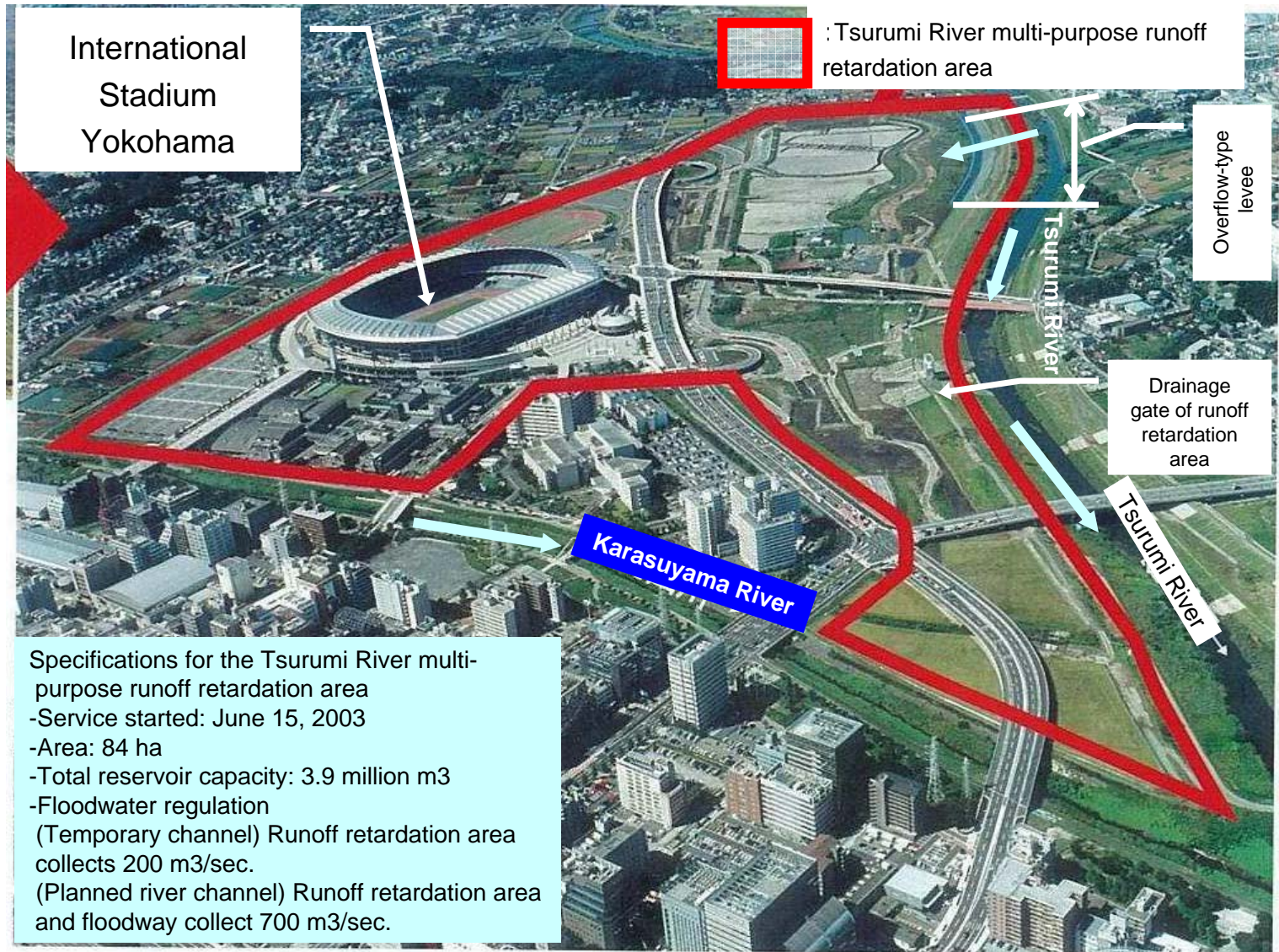
River related projects in Tsurumi River Basin inundation control plan

Future flood control

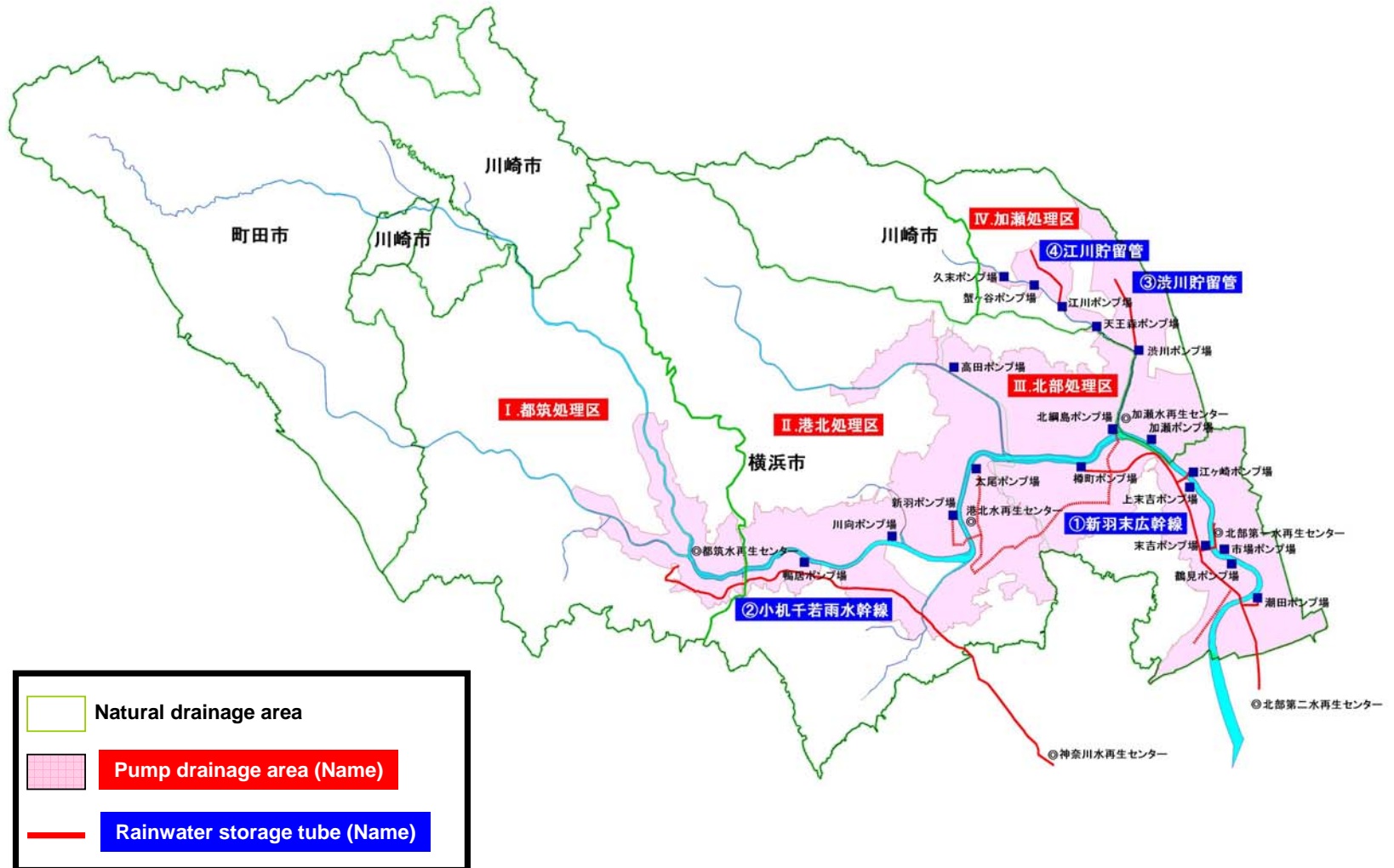
Existing retarding basin



Tsurumi River multi-purpose runoff retardation area



Sewerage projects in Tsurumi River Basin inundation control plan



Rainwater storage facilities

Development of facilities for target rainfall

Planned discharge in pump drainage areas

City	Discharge area	Planned discharge
Yokohama	Tsuzuki	17m ³ /s
	Kouhoku	142m ³ /s
	Hokubu	189m ³ /s
Kawasaki	Kase	55m ³ /s
Total		402m ³ /s

Planned storage of major facilities

City	Storage facility	Planned Storage
Yokohama	Shin hasue trunk line	410,000m³
	Kozukue chiwaka trunk line	256,000m³
Kawasaki	Shibukawa rainwater storage tube	144,000m³
	Egawa rainwater storage tube	81,000m³

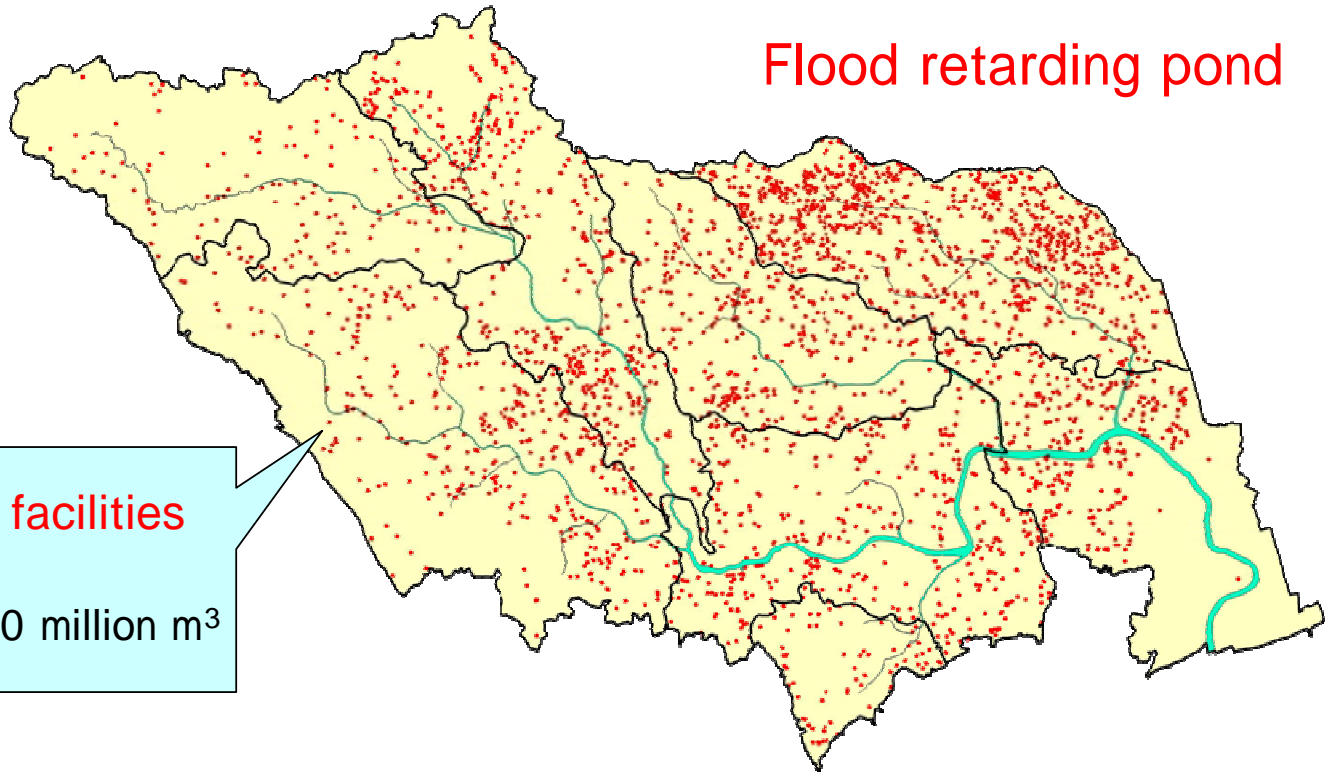
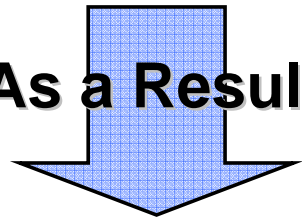


Present status and problems

-Present status of River Basin Management (Present status of flood control reservoir) -

Tsurumi river was designated as the first Comprehensive Flood Control River in 1979 to cope with rapid urbanization of river basin

As a Result



About **3,300 facilities**

Total volume 270 million m³

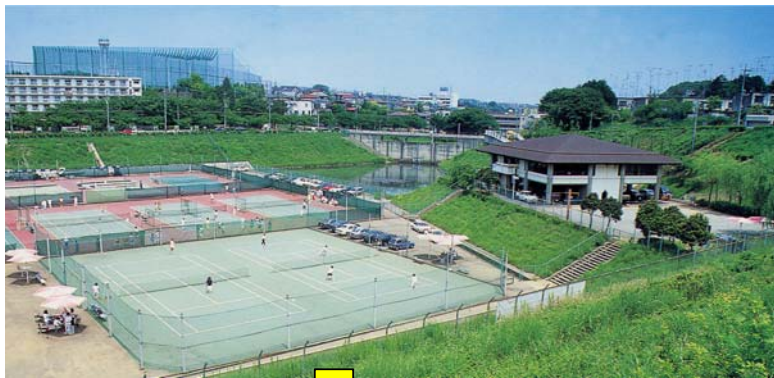
But more retarding ponds are necessary

Storage, infiltration and forest conservation

Development of rainwater storage and infiltration facilities,
conservation of forested areas (Total effect by municipalities : 0.3 million m³)

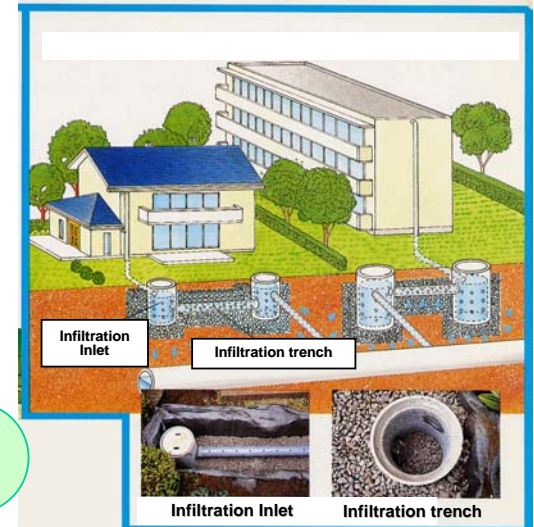
Storage

Storage facilities in schools,
parks and public houses



Infiltration

Infiltration by permeable pavement



Forest Conservation



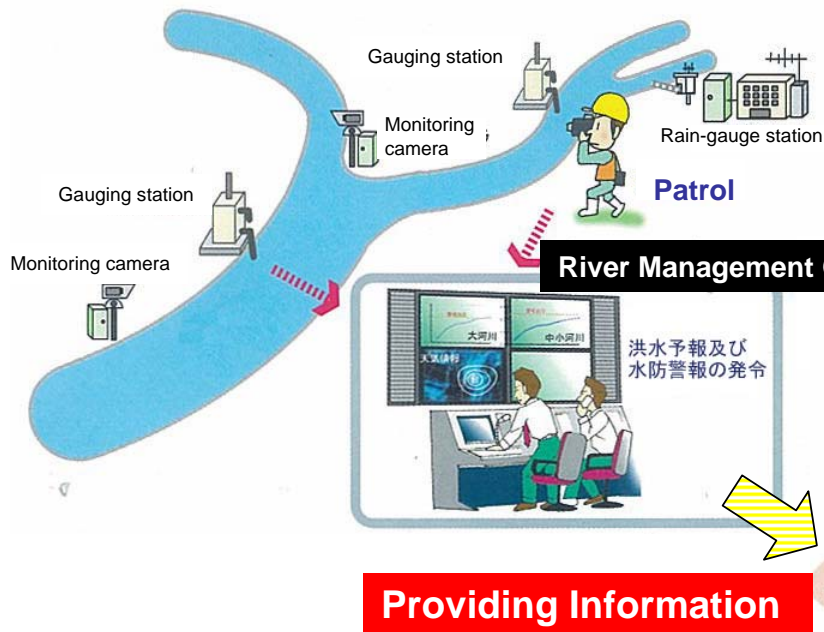
Purchase and conservation of forest in developing area

Measures against inundation damage

-Improvement of collecting and providing river information -

Providing necessary information, quick emergency response and minimizing damages in case of flood.

Collecting Information

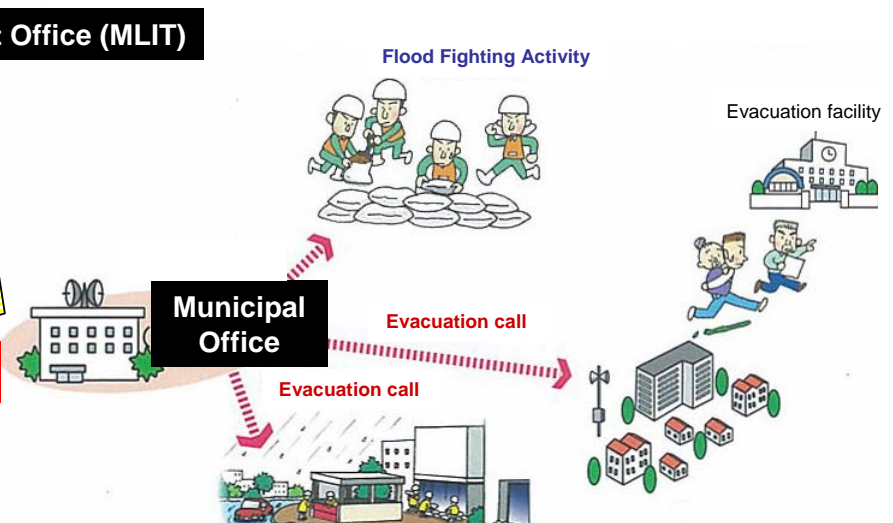


Providing information to the public

Home Page

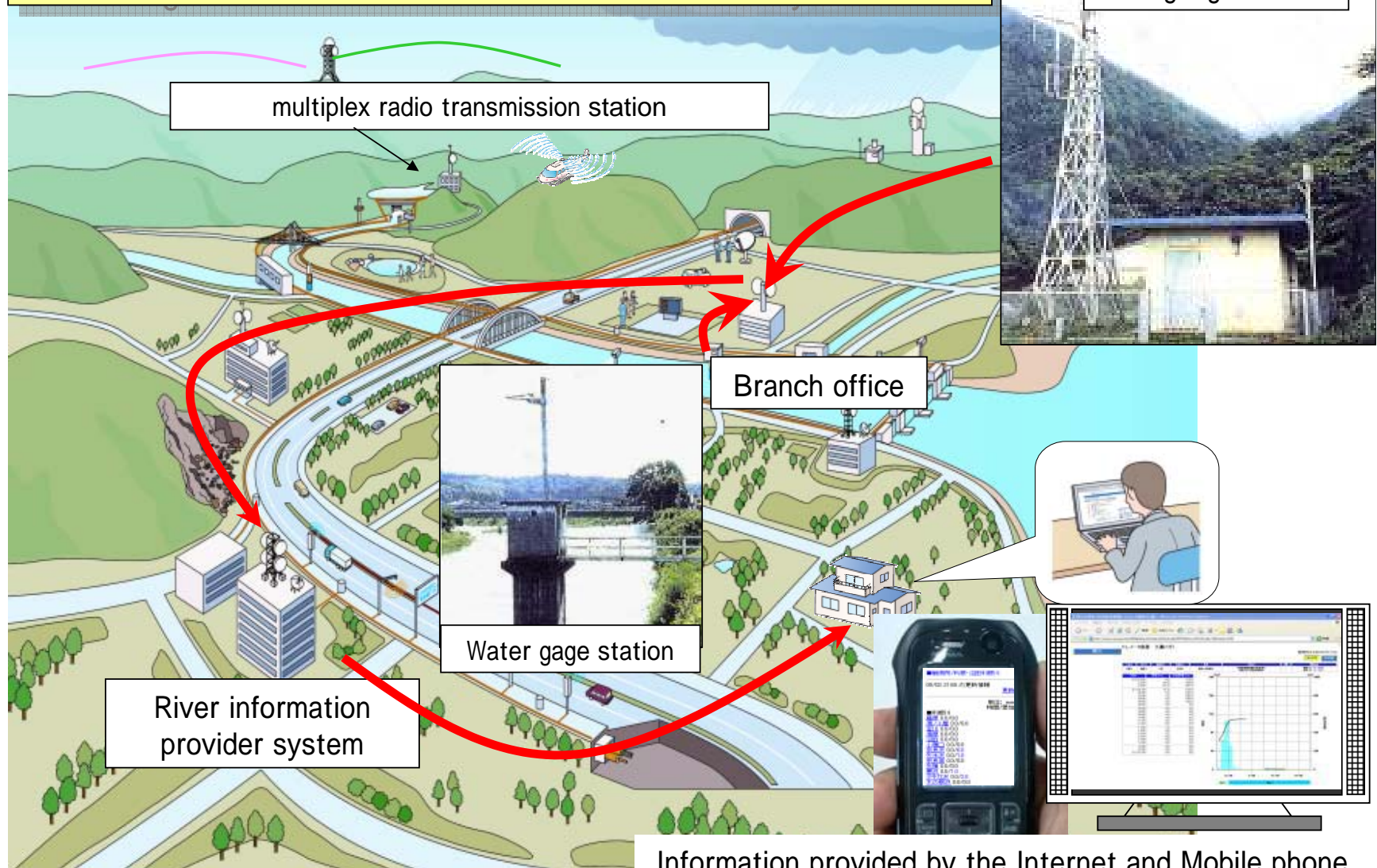
Mobile Phone

Information Board



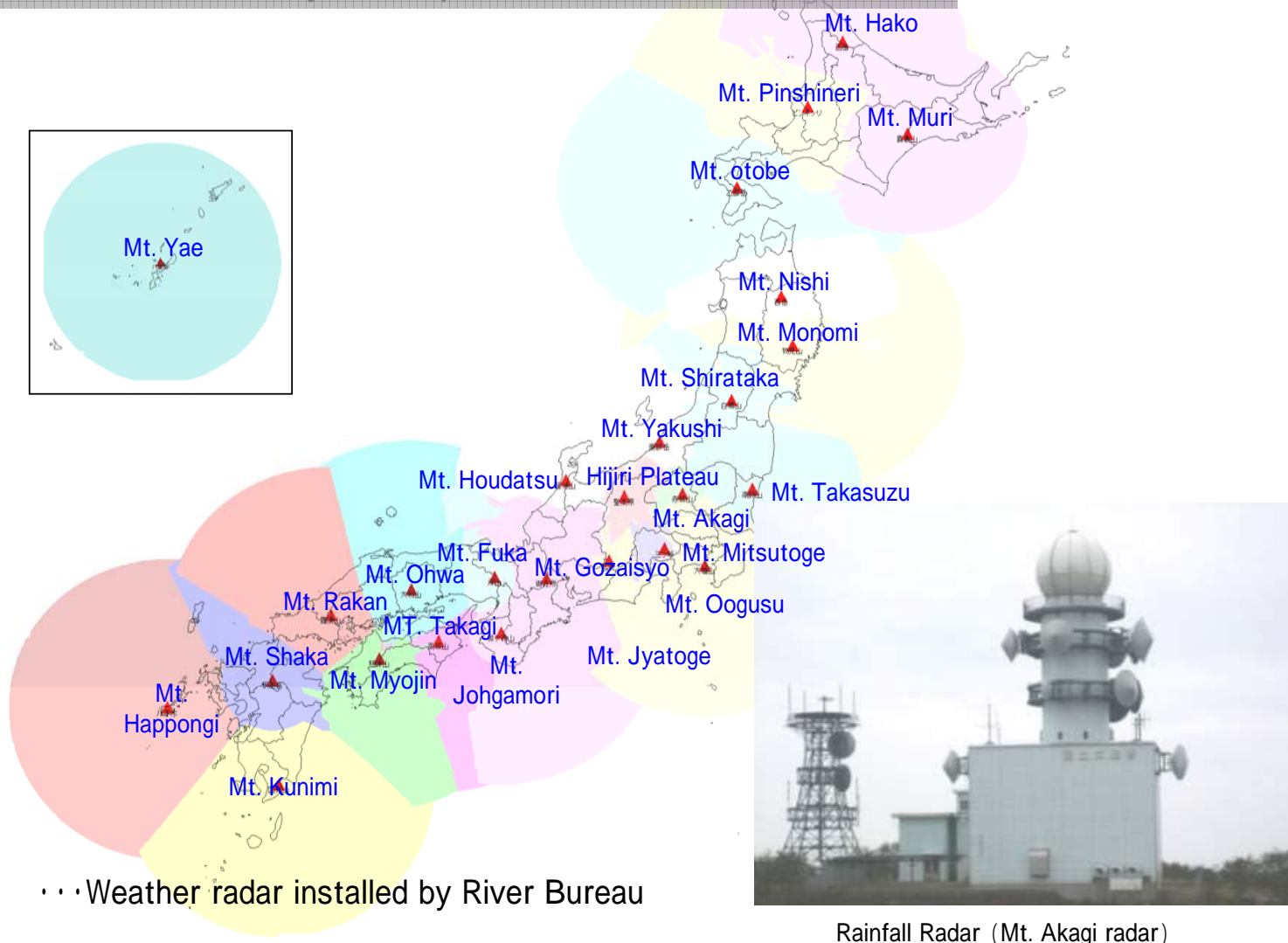
Water level and Rainfall observation by Telemeter

Providing Water level and Rainfall collected of by Telemeter



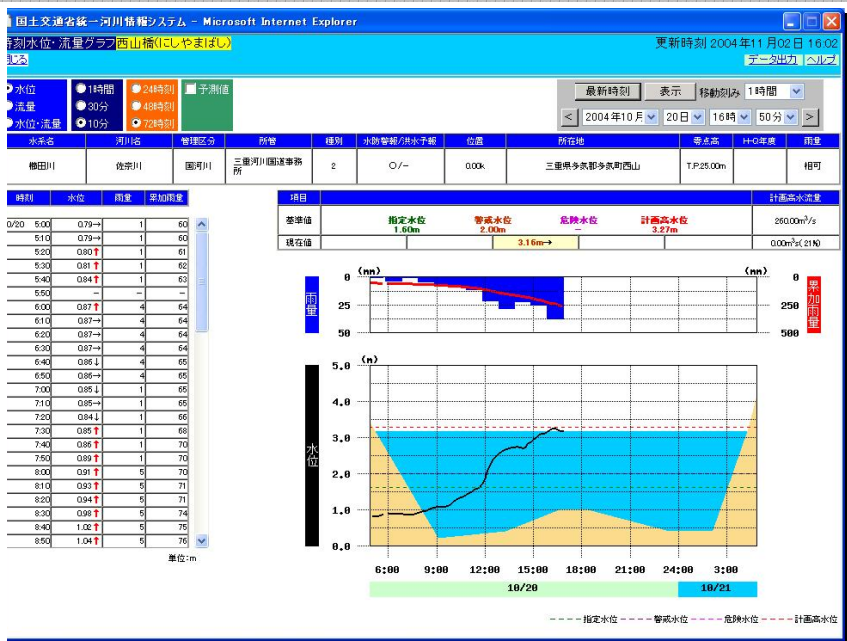
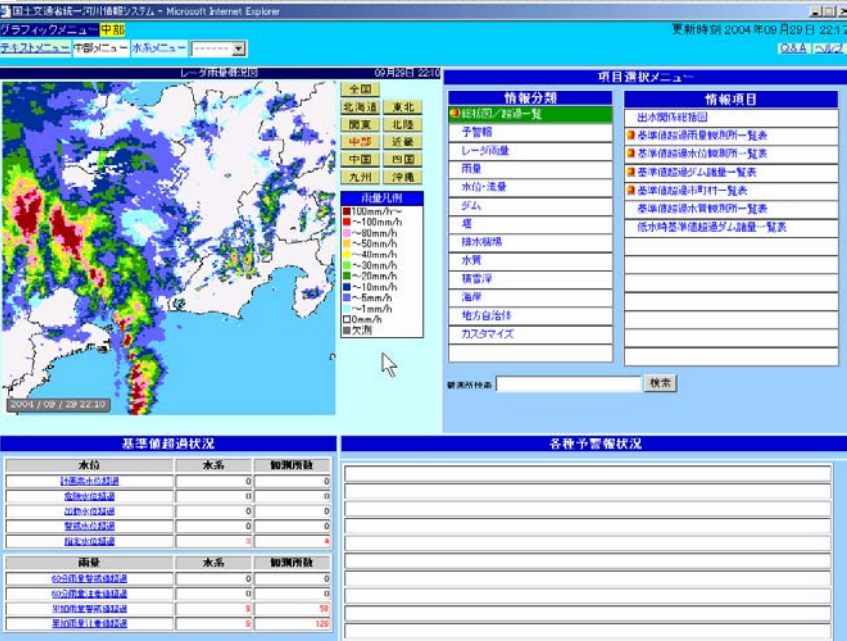
Location of rainfall observation radar

26 radar stations collect, analyze and provide rainfall data nationwide



Outline of River Information provider system

- The integrated river information system aims at sharing and standardizing river management data including river water levels and rainfall amounts.
- River information systems were originally developed by each regional development bureau. They have been integrated into a national river information system. Regional development bureaus can customize the system based on their requirements.
- Software are separated from hardware. Improvement cost and life-cycle cost are reduced.
- The system also provides rainfall forecasts of Japan Meteorological Agency and rainfall data of the Road Bureau.



Strengthen observation of localized heavy rainfall and information service

Upgrading rainfall forecast in corporation with related organizations

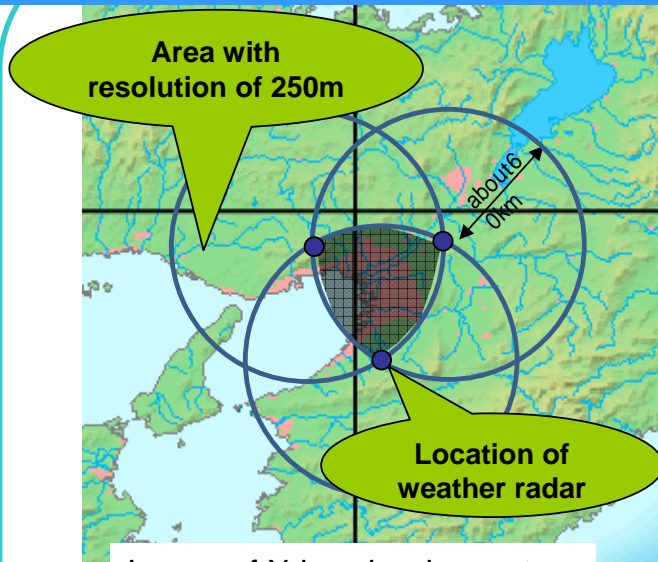


Image of X-band radar system

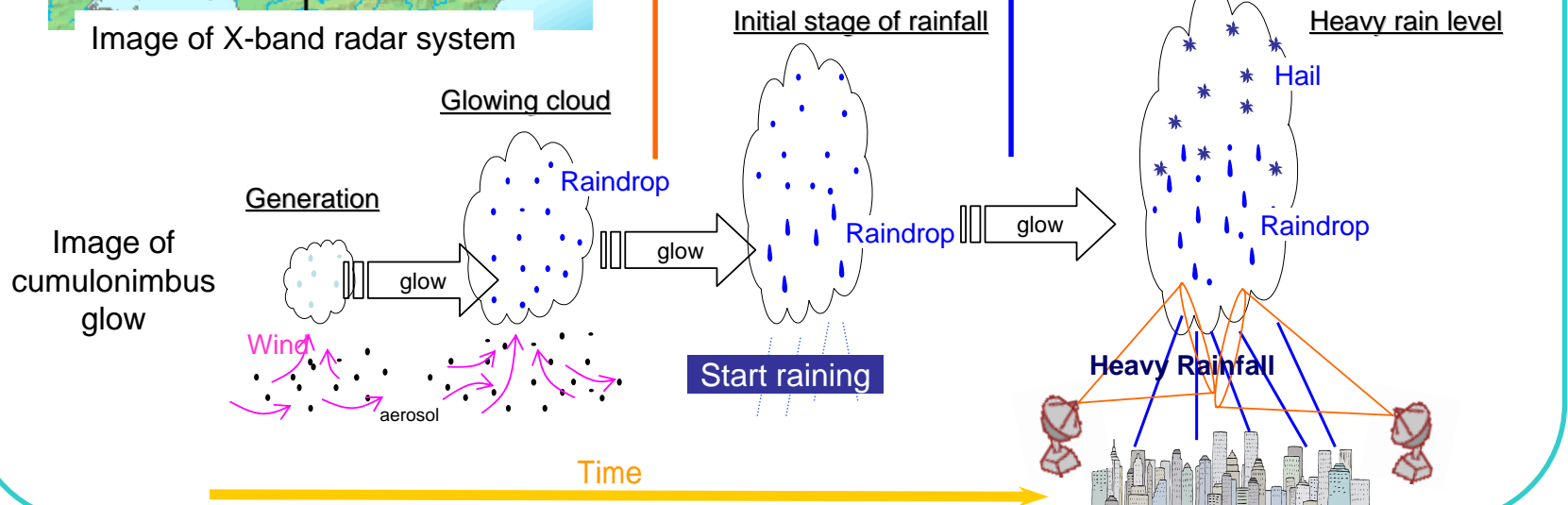
Aim at **early flood prediction for localized heavy rainfall** by establishment of Rainfall Prediction Model considering localized rainfall development and movement **by corporation with institutions concern**

Observation by X-band radar system

- Locate radar in a triangular shape in urban area
- High resolution and real-time rainfall observation within 60km range from radar
- Furthermore, prediction accuracy is improved by three-dimensional observation of rainfall within the triangle area

Rainfall observation by X-band radar

Rainfall observation by current C-band radar



Policies for Water Resources Development

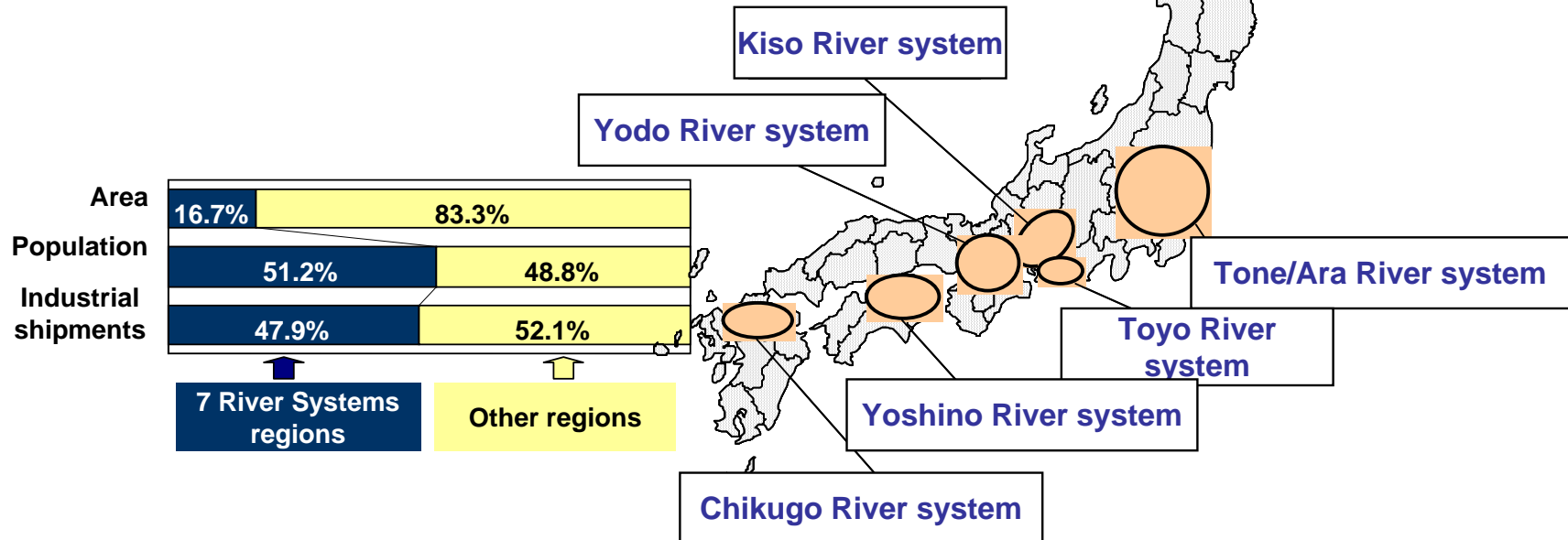
-Water Resources Development Basic Plan-

Water Resources Development Basic Plan

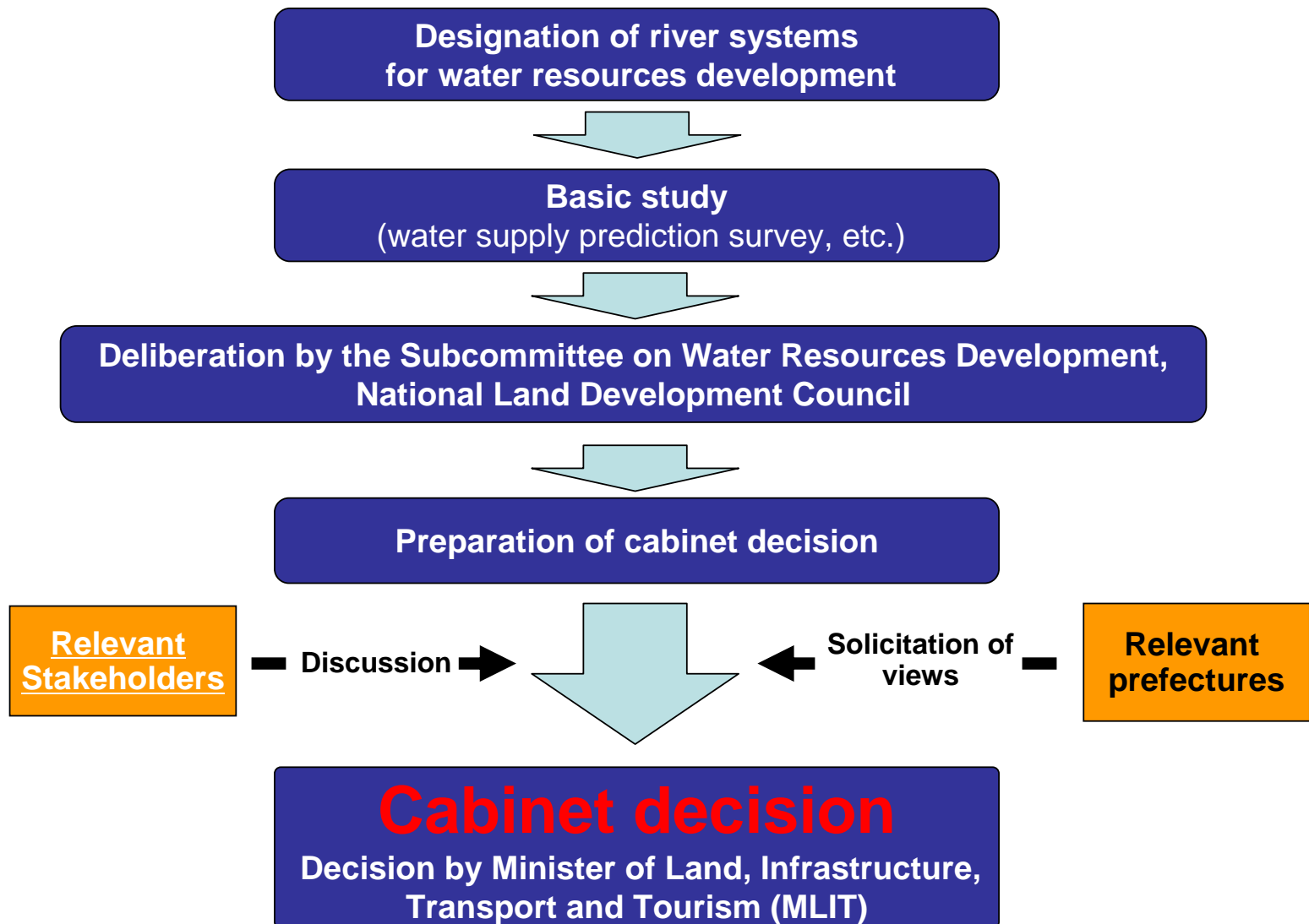
- Purpose-specific demand forecasts and supply for 7 river system

Japan Water Agency (JWA)

- Established in 1962 to promote water resources development

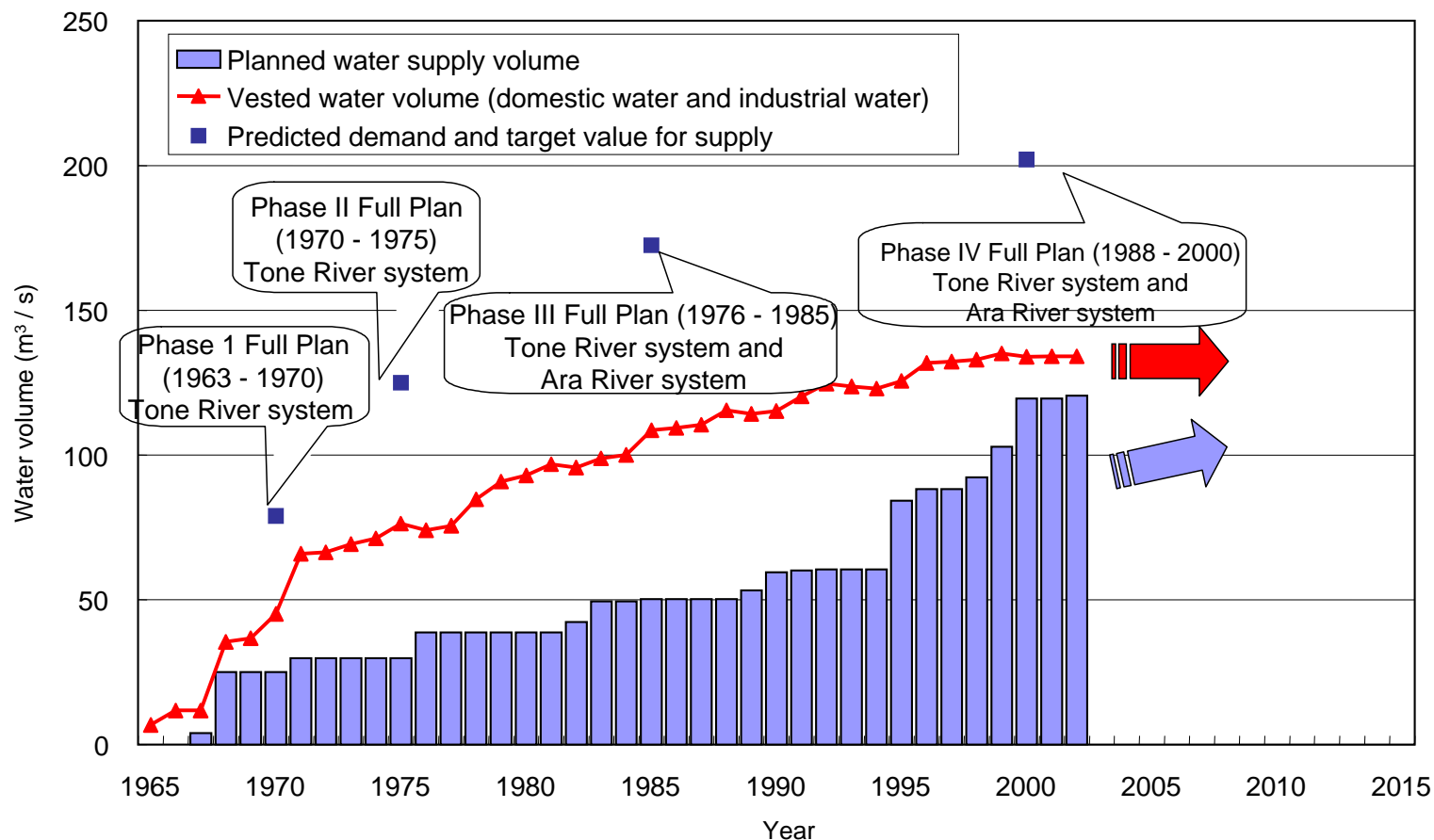


Procedure for Enacting Basic Plans under the Water Resources Development Law



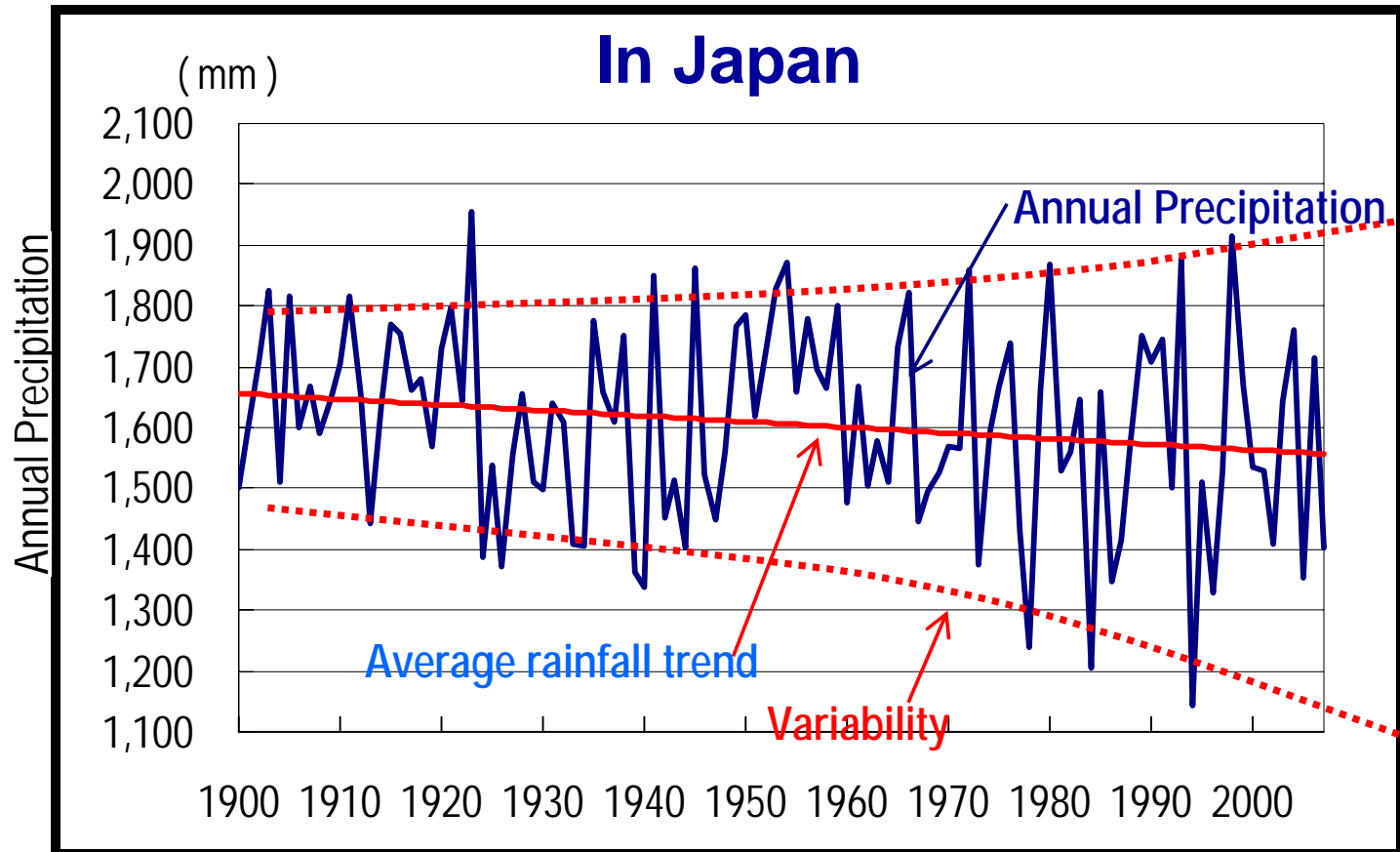
Effect of Basic Plans (Tone/Ara River System)

Minimizing the Gap between Demand and Supply



- Planned water supply volume: Volume of water developed by dams, etc.
(not including facilities under construction and water diverted under agricultural rationalization projects in the winter.)
- Vested water volume: sum of secured water rights and provisional water rights

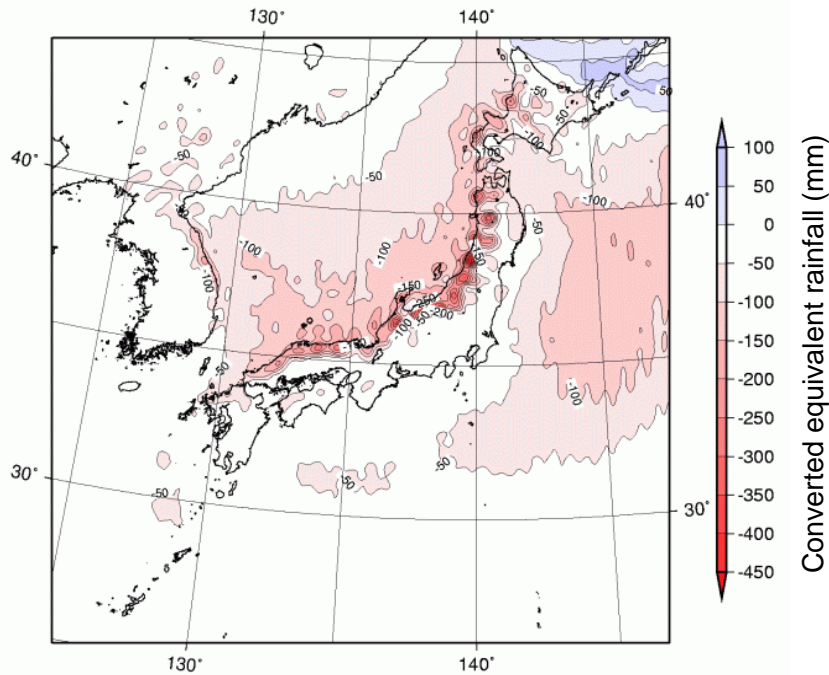
Variability of extreme events is increasing due to climate change



Climate change prediction

—Snowfall—

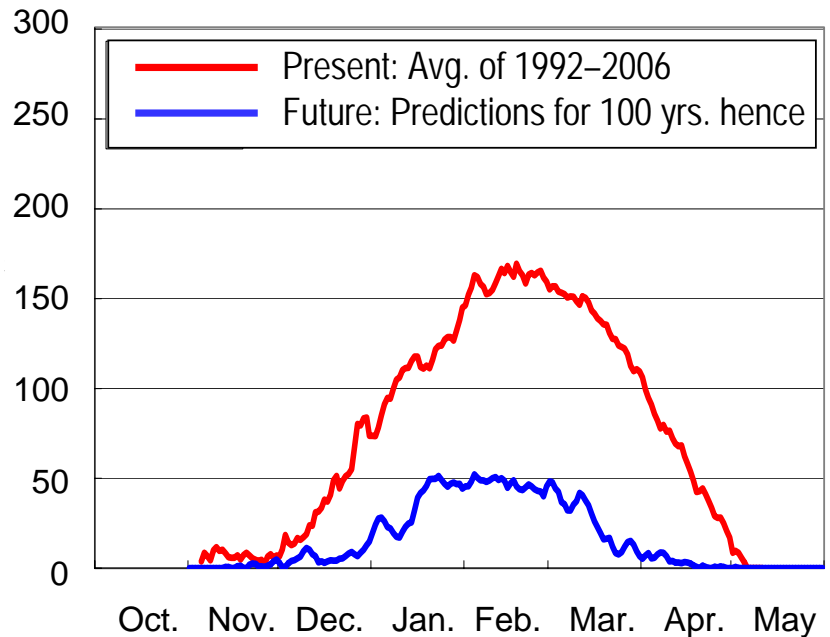
Snowfall will dramatically decrease in the northern regions.



Changes in annual snowfall
(avg. of 2081 2100) (avg. of 1981 2000)

In a 100 years' time, the upstream catchments of the Tone River will have considerably less snow depth.

Snow depth (cm)



Snow depth changes
expected 100 years hence (Fujiwara)

Source: Global warming projection vol. 6 (JMA)

Prolonged droughts are expected due to climate change

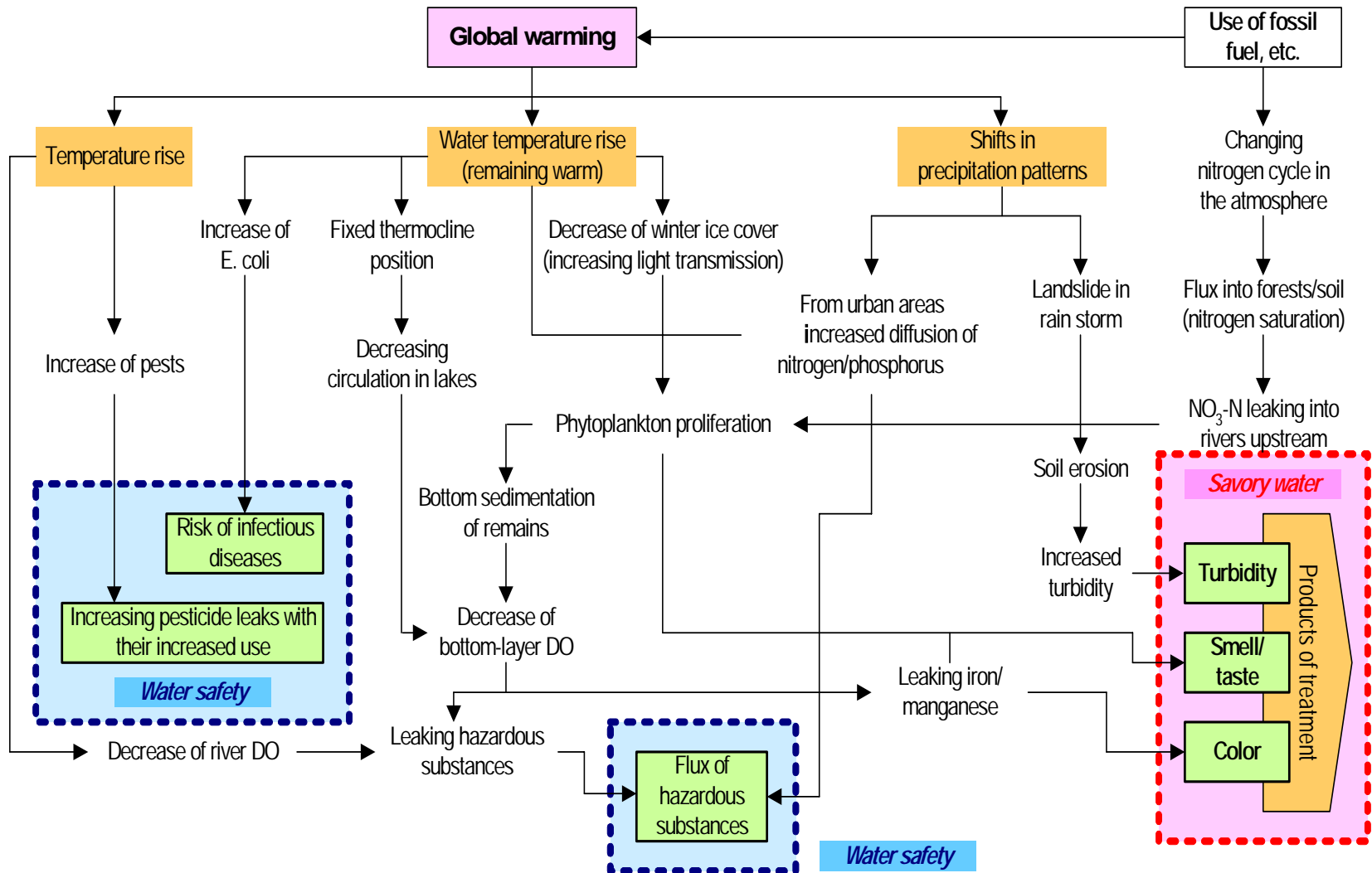
River Basin	Dam	Irrigation period pattern	Drought periods at present state (days/10yrs)	Drought periods at around 2050 (days/10yrs)
Ishikari	Taisetsu	Advanced by 0-10 days	About 60 days	About 30-70 days
	Chubetsu	Advanced by 0-10 days	About 30 days	About 130-180 days
Tone	8 dams	Advanced by 0-40 days	About 30 days	About 100-110 days
		Deferred by 0-60 days	About 30 days	About 90-120 days
Chikugo	Matsubara/ Shimouke	Advanced by 0-5 days	About 50 days	About 70 days
		Deferred by 0-30 days	About 50 days	About 70-80 days

Droughts mitigated

Droughts exacerbated

Impacts of Climate Change on water quality

due to climate change



Basic point of view for promoting IWRM

Addressing adaptation to climate change and social change

Addressing climate change

Prepared for more frequent,
extreme events

Coping with changed
hydrological/ environmental
situation

Addressing Social needs

Coordinated use of water
resources

Ensuring safe water supply
and sanitation



Policy Framework to ensure adaptation to climate change through IWRM

Integrating management of water
demand and supply

Integrating water facility planning,
designing and operation

Information sharing and stakeholders'
participation

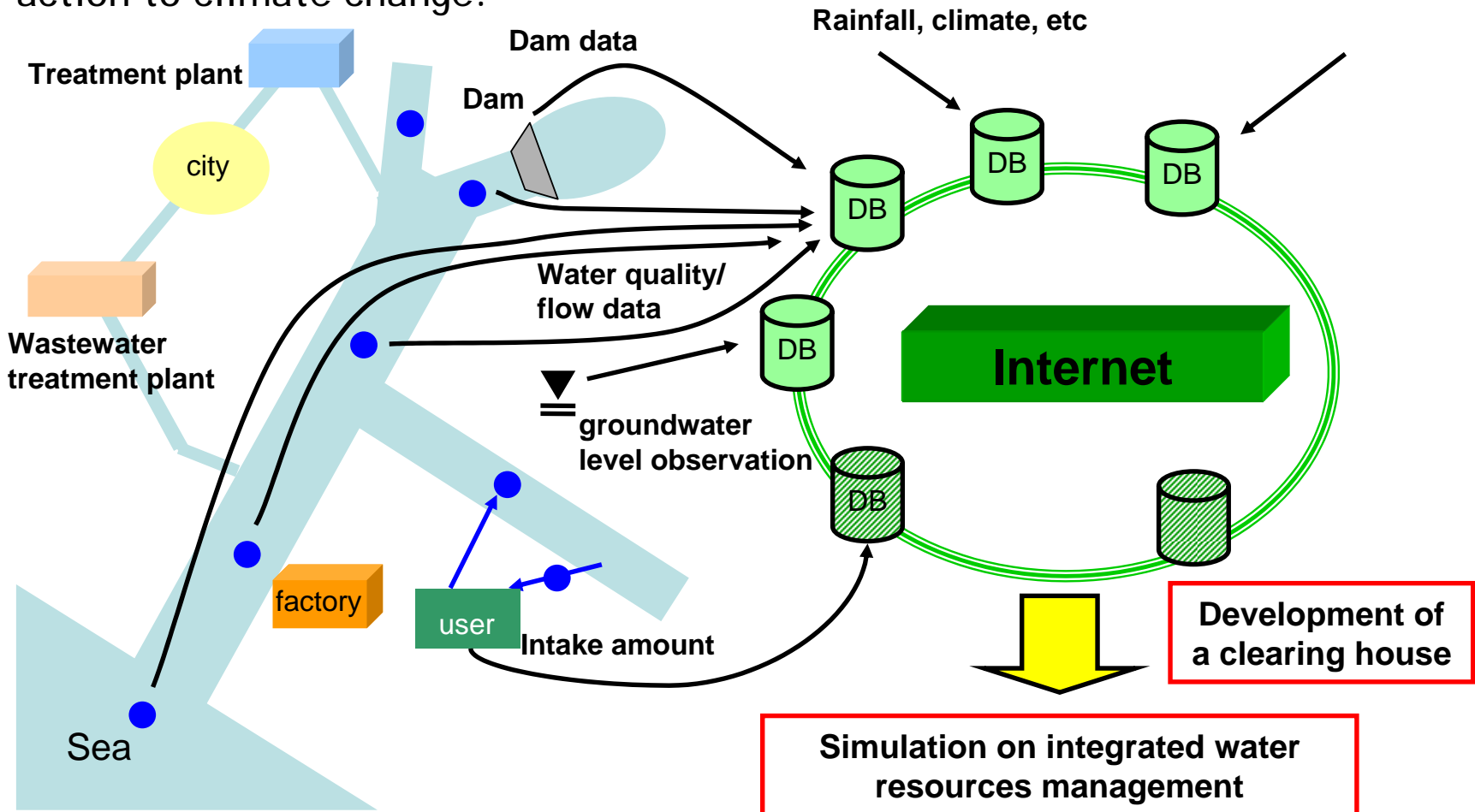
Integrating management of surface water
and ground water

Integrating management of water
quantity and quality

Information sharing and stakeholders' participation

Information system to involve stakeholders in IWRM:

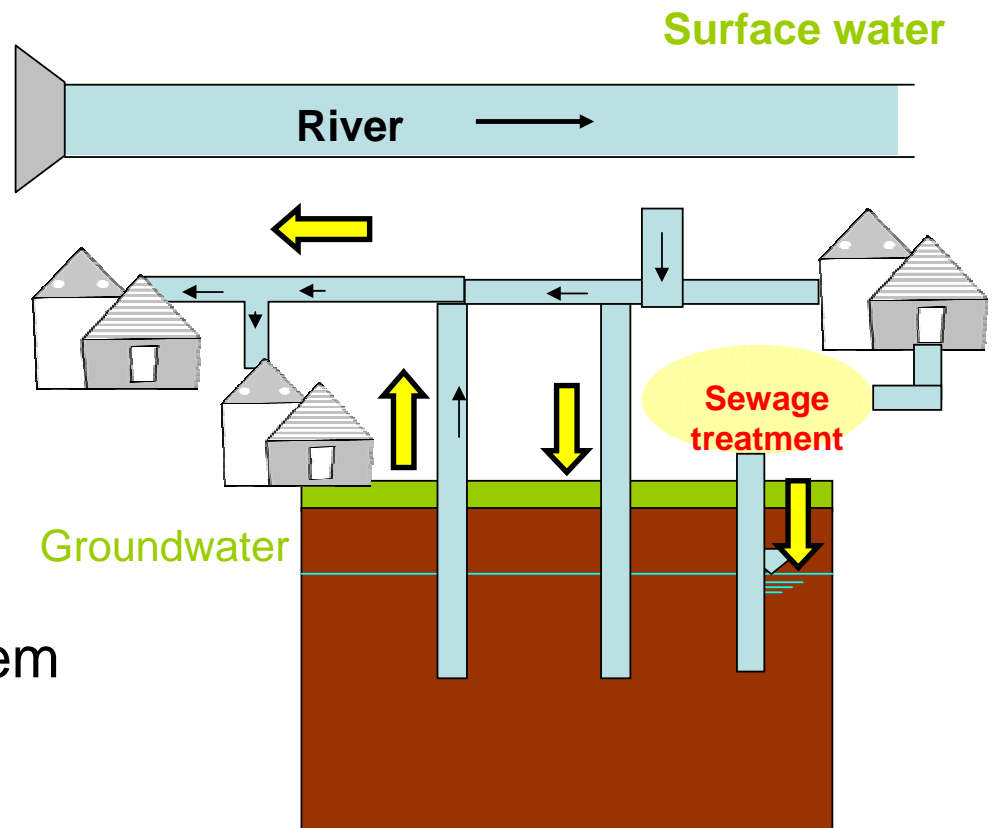
In decision making, consensus building, awareness raising , etc. for adaptation action to climate change.



Integrating monitoring, withdrawal, and recharge of surface water and ground water

Required sub-action

- ✓ Policy and regulatory framework
- ✓ Groundwater Monitoring and assessment
 - ✓ Groundwater level
 - ✓ Groundwater quality
 - ✓ Withdrawal amount
- ✓ Coordination mechanism between managers
- ✓ Information Sharing System



Integrated management of water quantity and quality

Effective management by many stakeholders for effective and smooth implementation.

