1. Japan's basic flood protection system

2. Preparedness for major floods

- Past major floods and state-level efforts
- Role of MLIT

MLIT's emergency response system to cope with major floods

Emergency status

・In the case where an organization such as a regional development bureau has moved to the emergency status and serious damage has occurred or may occur

・In the case where extensive windstorm or flood damage is almost certain to occur and in any of the following cases:

(a) The likelihood of occurrence of a levee breach in a particular river section is high or such a breach has already occurred and the occurrence of extensive damage is thought likely.

(b) Extensive damage due to a storm surge is almost certain to occur, judging from the magnitude, intensity, course and speed of a typhoon and tide level and other information.

(c) Extensive damage due to mass movement, etc., has occurred and the occurrence of further damage due to mass movement, etc., is thought likely.

(d) Serious human suffering or property damage other than those mentioned above has occurred or may occur.

Alert status

・An organization such as a regional development bureau has moved to the alert status.

・Transportation facilities that could affect many passengers have been damaged because of the approach, landfall or other behavior of a typhoon.

Watch status

・An organization such as a regional development bureau has moved to the watch status.

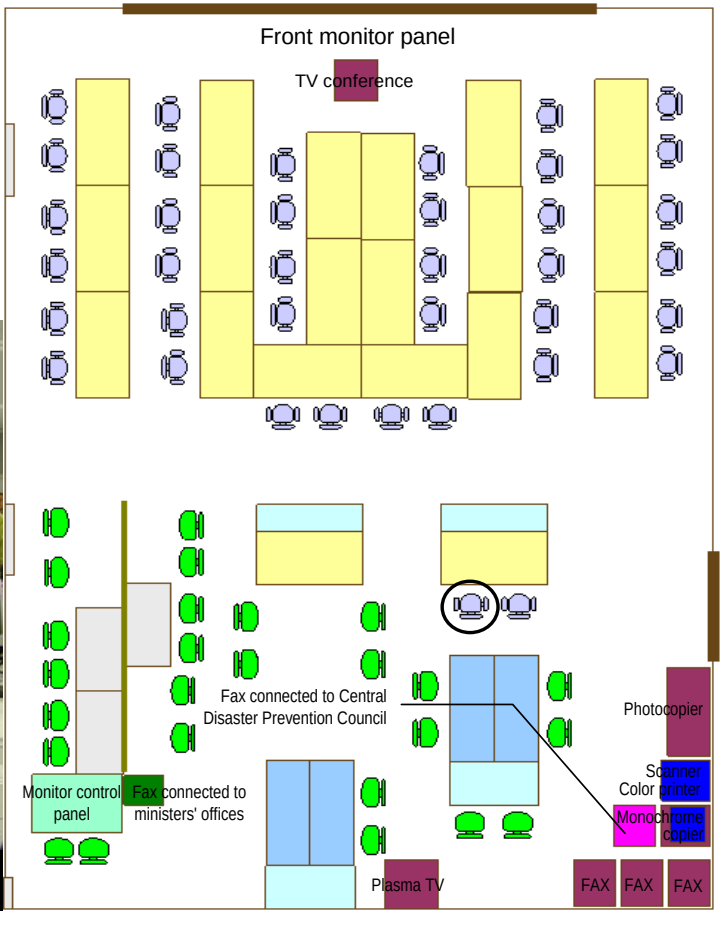
・Transportation systems in two or more prefectures have been rendered inoperable because of the approach, landfall or other behavior of a typhoon.

Role of MLIT

- Mobilizing leaders, staff members and related department members
- Observing and distributing meteorological information, site images, etc.
- Collecting and sharing information (integrating damage information)
- Exchanging information with ministers' offices, other ministries and agencies, local departments, etc.
- Providing information to the public
- Regional assistance, assistance to local governments

MLIT's disaster prevention center

14th floor, Building No. 2



MLIT's response to a major emergency (state level response to the 2004 flood (Typhoon No. 23))

Ministry of Land, Infrastructure, Transport and Tourism

○On October 20, 2004, Typhoon No. 23 caused serious damage in Hyogo Prefecture and the northern part of Kyoto Prefecture. River levees were breached at several locations. For the MLIT-managed Maruyama River, where flood damage was particularly severe, temporary restoration works were carried out with the assistance of nearby regional development bureaus in order to guard against future flooding. Temporary restoration works at two sites were completed in five days.

Levee breaches along the Maruyama River (2 locations)

Levee damage
Levee breach site: around 5.4 km point on the left bank of the Izushi River

Levee damage
Levee breach site: around 13.2 km point on the right bank of the Maruyama River

Experts were dispatched to Toyooka City, etc. (steep slope sites)

Inundation in the city of Toyooka

Site visit by MLIT Minister Kazuo Kitagawa

Twenty-eight pumper trucks were called in from around the country

Emergency investigation using a helicopter

Vehicle for emergency use

MLIT operation

Pumper truck

Maruyama River

Yura River

4 pumper trucks

7 pumper trucks

4 pumper trucks

13 pumper trucks

MLIT

Around-the-clock work for temporary restoration of levees

The Yura River, too, flooded in Kyoto Prefecture. In Maizuru City, a tour bus was submerged on Route 175, and 37 passengers were stranded on the roof of the bus. About 11 hours later, the passengers were rescued by a Japan Coast Guard rescue team.

Twenty-eight pumper trucks were called in for drainage work.

Kinki Regional Development Bureau:	13 pumpers
Chubu Regional Development Bureau:	4 pumpers
Hokuriku Regional Development Bureau:	4 pumpers
Chugoku Regional Development Bureau:	7 pumpers

Temporary restoration of the MLIT-managed river sections (two levee breach sites) were completed in five days with the assistance of nearby regional development bureaus. The levee breaches in the sections managed by Hyogo Prefecture (four sites) were smaller than the breach sites in the MLIT-managed sections, but the temporary restoration of the four breached sections took 17 days.

MLIT's assistance to prefectures in case of a major disaster (Niigata-Fukushima Heavy Rains in 2004)

To cope with the flooding of the Kariyata and Ikarashi rivers managed by Niigata Prefecture, pumper trucks and mobile lighting systems were dispatched not only from within the region covered by the Hokuriku Regional Development Bureau but also from the Tohoku, Kanto and Chubu regional development bureaus.

Dispatched emergency equipment

Pumper truck	36 units
Breakdown Hokuriku Regional Development Bureau	20 units
Tohoku Regional Development Bureau	5 units
Kanto Regional Development Bureau	8 units
Chubu Regional Development Bureau	3 units
Mobile lighting system	17 units
Breakdown Hokuriku Regional Development Bureau	11 units
Tohoku Regional Development Bureau	3 units
Kanto Regional Development Bureau	3 units
Satellite communications vehicle	1 unit
Mobile command vehicle	2 units
Standby support vehicle	3 units
Ku-SAT	4 units
Portable helicopter TV receiver station	1 unit
Truck-mounted drain cleaning machine	1 unit
Truck-mounted roadside gutter cleaning machine	1 unit

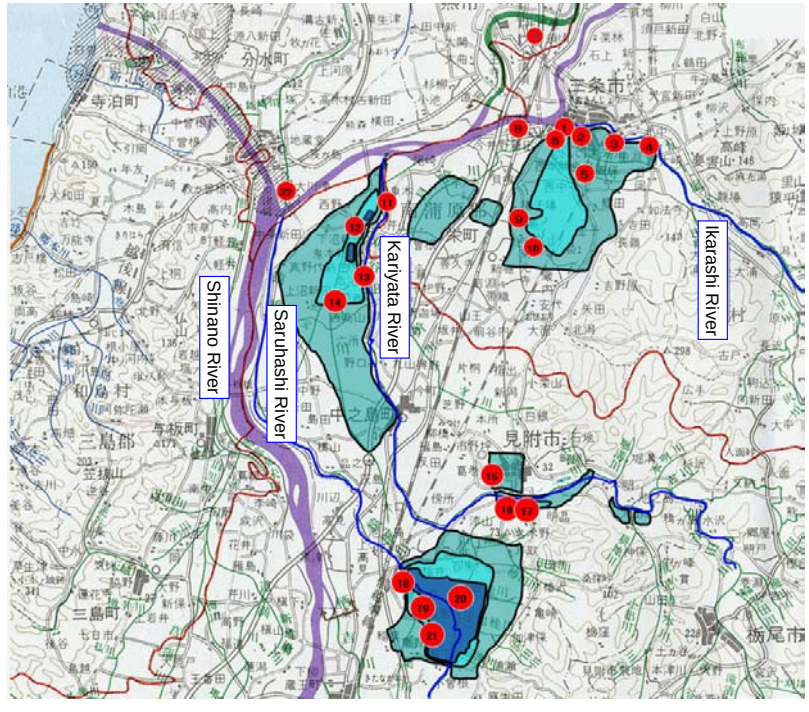
Pumper truck in action

Nighttime work using a mobile lighting system

Inundation damage mitigation by use of pumper trucks

○12 municipalities in Niigata Prefecture
(Sanjo City, Mitsuke City, Nagaoka City, Nakanoshima-machi, Sakae-machi, Niigata City, Gosen City, Tsubame City, Mishima-machi, Bunsui-machi, Tagami-machi, Koide-machi)

○3 municipalities in Fukushima Prefecture
(Kitakata City, Aizubange-machi, Shiokawa-machi)



Inundation areas and pumper truck locations

Legend
- Inundation area on July 14
- Inundation area at 16:00 on July 15
- Inundation area at 16:00 on July 18
- Pumper truck location

MLIT's assistance to local governments in case of emergency

Ministry of Land, Infrastructure, Transport and Tourism

Assistance process flow

Prevention of further spread of damage in the affected area and early restoration and recovery → **Timely and effective support and assistance to local governments, etc.** → **Dissemination of information on options for support and assistance to local governments, etc., in the affected area**

Assistance options

①Providing images, maps, information, etc. (e.g., providing images of the affected area)	⑤Shelters, relief goods, etc. (e.g., providing shelters, using "Michi no Eki" (stopovers along national roads))
②Risk evaluation, etc. (e.g., inspection of mass movement risk sites)	⑥Housing (e.g., assistance for the construction of temporary housing)
③Damage survey (e.g., assistance for damage surveys, disaster prevention expert assistance for surveys)	⑦Post-disaster restoration (e.g., technical assistance for post-disaster restoration)
④Support (e.g., lending emergency vehicles, dispatching experts)	⑧Recovery (e.g., assistance for recovery planning, assistance for tourism campaigns)

Adopted by MLIT's disaster prevention council on June 27, 2005

Currently available emergency resources

Mobile command vehicle

Emergency helicopter

Satellite communications vehicle

Mobile lighting system

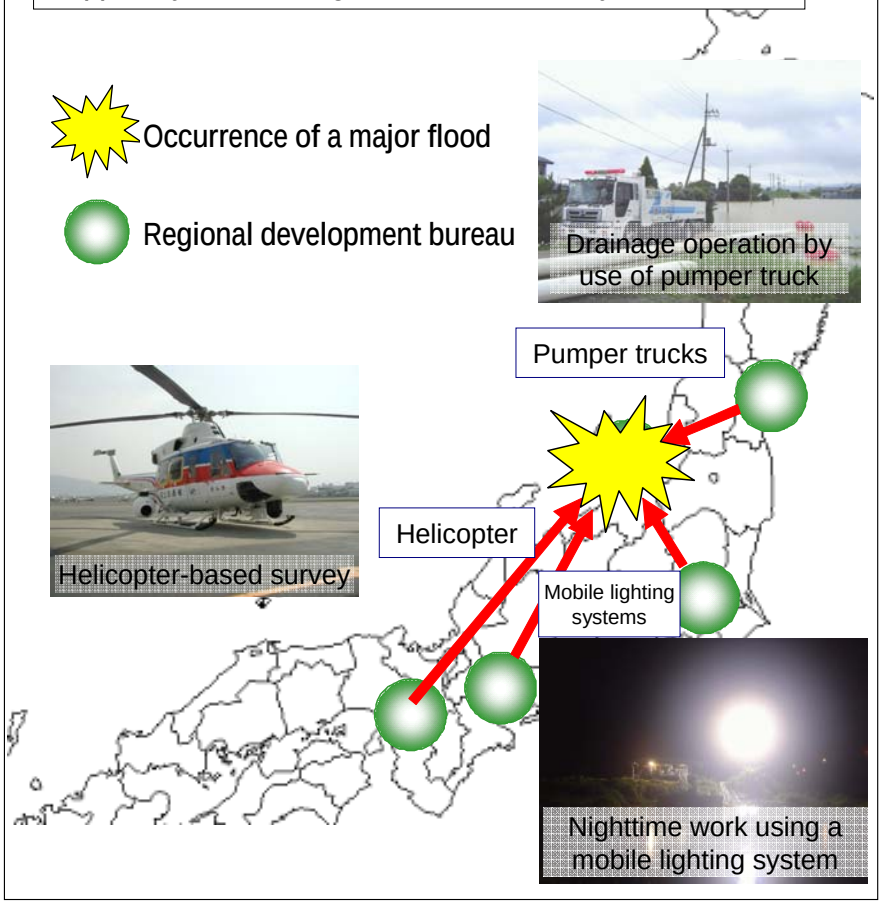
Portable image transmission system: Ku-sat

Establishment of Technical Emergency Control Force (TEC-FORCE*)

Ministry of Land, Infrastructure, Transport and Tourism

※Technical Emergency Control Force

Support system for Niigata-Fukushima Heavy Rains in 2004



Necessity of regional support system

Purpose

- Prompt collection of information on the state of damage in a major natural disaster and early restoration of the affected area
- Smooth and timely provision of technical assistance to local governments, etc.

Activities

- ●Prompt collection of information on the state of damage
- ●Early restoration of infrastructure
  - Faster initiation of response activities
  - Intensive response by a team of experts
  - Improvement and strengthening of technical guidance concerning restoration measures
- ●Prevention of secondary damage
  - Sophisticated technical guidance related to damage sites
  - Emergency measures (planning and implementation)
  - Risk level prediction (judgment on evacuation)
- ●Other emergency response measures
  - Coordination of emergency transportation

TEC-FORCE member appointment status

- Personnel of MLIT, regional development bureaus, district transport bureaus, National Institute for Land and Infrastructure Management, etc.

Total: 2,563 members (as of October 1, 2008)

Activities of TEC-FORCE

The TEC-FORCE was dispatched after the Iwate-Miyagi Nairiku Earthquake (from June 14, i.e., the day of the earthquake, to July 22) and the Iwate-ken Engan Hokubu Earthquake (from July 24, i.e., the day of the earthquake, to July 29) to investigate the affected areas, provide guidance on restoration methods, take secondary damage prevention measures.

Activity results

Iwate-Miyagi Nairiku Earthquake:	**515 vehicle-days, 1,499 person-days**
Iwate-ken Engan Hokubu Earthquake:	**4 vehicle-days, 381 person-days**

Advance team (helicopter-based survey)

Telecommunications team

Specialized technical guidance team (river channel blocking)

Direction of future MLIT efforts

Clarification of goal: Working toward "zero victims"

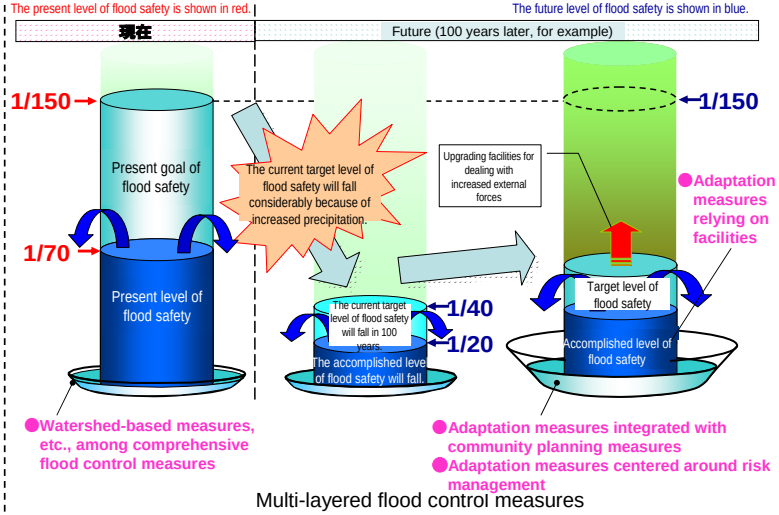
Complete protection from increasingly severe floods, etc., is difficult to achieve. ⇒ Minimization of damage

- Studies are conducted on ways to achieve **"zero victims."**
- In the areas where key state functions are concentrated, priority measures such as **measures to prevent complete impairment of the state functions are taken.**

Measures to cope with growing external forces

(Multi-layered flood control measures)

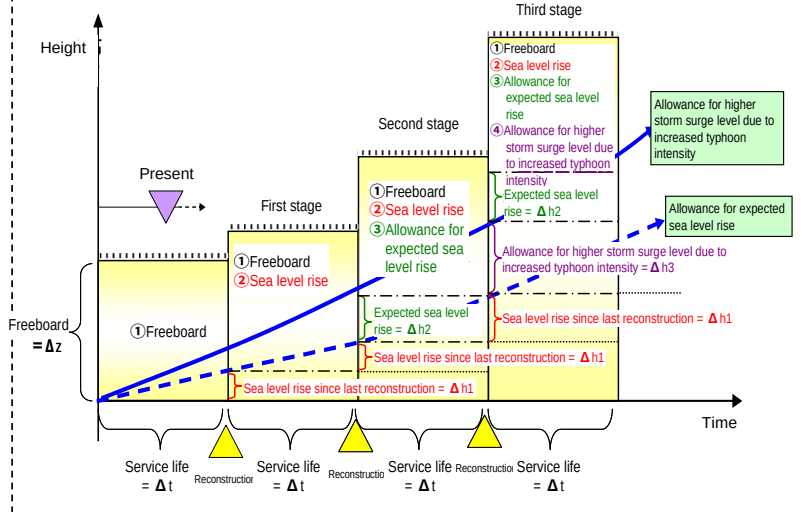
- In addition to the flood control measures designed to ensure safety from the design-basis discharge, watershed-based measures are also taken to ensure safety from growing external forces.



Multi-layered flood control measures

(Phased safety measures against storm surges and upgraded measures against ongoing coastal erosion)

- In order to ensure safety from storm surges, coastal structures are raised when, for example, they are reconstructed to guard against growing external forces.
- From the viewpoint of protection from ongoing coastal erosion, effort is made to implement comprehensive sediment control measures.



Phased upgrading of storm surge protection measures

River improvement plan incorporating measures against climate change

- **A road map indicating the procedures for adaptation measures is prepared, taking the impact of climate change into consideration.**
- **The potential disaster risk of the watershed under consideration is evaluated by monitoring the present state of climate change and predicting the future state.**
- **The evaluated disaster risk is shared in the watershed to consider adaptation measures to be taken and reflect the findings on the road map.**
- **Adaptation measures to be taken are prioritized according to the degree of necessity, and effort is made to achieve mainstreaming of climate change adaptation.**

River improvement plan adapted to cope with climate change

Plan

Devising adaptation measures and preparing and modifying a road map

- Devising adaptation measures to cope with climate change
- Adaptive response according to the road map

Do

Implementing adaptation measures

Implementing measures in cooperation with the organizations concerned

Check

Evaluating adaptation measures through flood risk evaluation

- Establishing a flood risk evaluation method and reviewing the flood control economics study

Action

Reviewing adaptation measures and the road map

Considering additions or changes to adaptation measures and the road map on the basis of evaluation results

Monitoring of climate change

- Analyzing and evaluating (assessing) the impact of climate change
- Preparing a global warming report in cooperation with the Japan Meteorological Agency

Example of flood risk analysis

Concepts of flood risk analysis associated with different phenomena

River flooding due to typhoon-induced heavy rains or torrential downpours and inundation due to localized heavy rains are different phenomena that require different zoning approaches for flood risk analysis.

Analysis — Tasks performed in inundation-prone area mapping and hazard mapping

Typhoon-induced heavy rain, torrential downpour

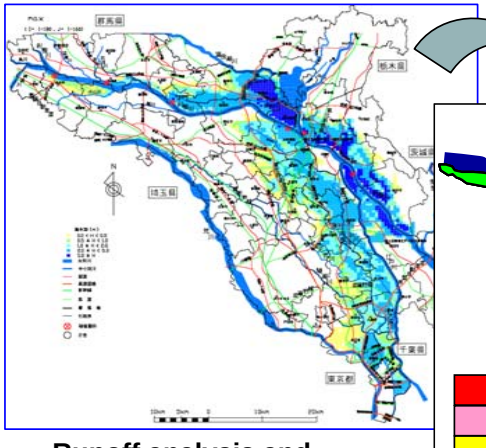
- Review of past floods
- Runoff analysis and inundation analysis
- Zoning into inundation blocks

(tasks that are usually not performed for inundation-prone area mapping)

Torrential downpour, localized heavy rain

- Review of inundation damage records
- Inundation simulation
- Zoning into drainage areas and flooding areas

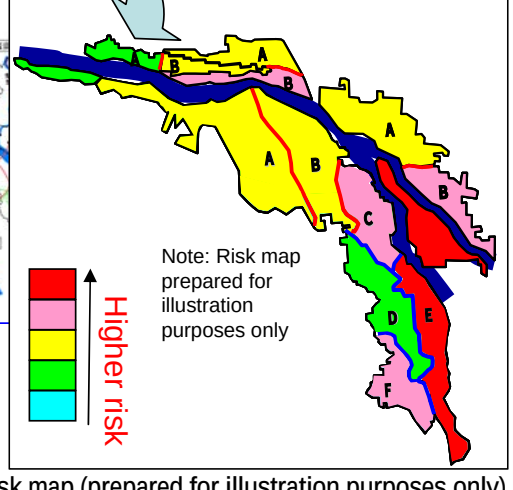
(tasks that are usually not performed for inundation-prone area mapping)



Runoff analysis and inundation analysis

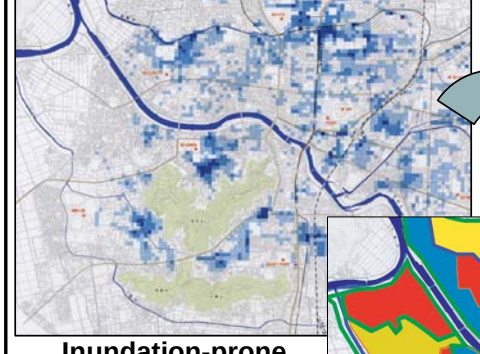
Source: Data prepared for the fifth session of the Special Board of Inquiry on Measures against Major Floods

Classification of inundation patterns



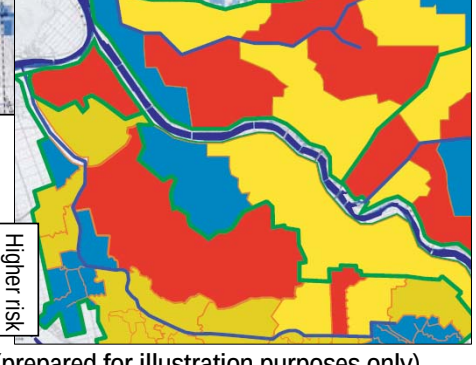
Note: Risk map prepared for illustration purposes only

Risk map (prepared for illustration purposes only)



Inundation-prone area map

Zoned into drainage areas and inundation areas



Risk map (prepared for illustration purposes only)

Example of flood risk analysis

Road mapping by use of flood risk evaluation

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A road map indicating the adaptation measures to be taken and procedures to be followed for different types of inundation and different blocks is prepared and shared within the watershed.

Road map (typical example)

	Type of inundation	Block	Place name	Present damage risk	Target level of damage risk 30 years later	Planned facilities	Facility plan (1-10 years) / Facility plan (11-30 years)
Right bank	Type of inundation①	A	AAA Town, BBB City	Green	Green		
	Type of inundation②	A	CCC Town, DDD City	Yellow	Blue	Levee reinforcement	
						Road embankment	
						Disaster prevention station	
		B	EEE Town, FFF City	Yellow	Green	Levee reinforcement	
						Road embankment	
		C	GGG Town, HHH City	Pink	Green	Road embankment	
						Flood control reservoir	
		D	III Town, JJJ City	Green	Blue		
		E	KKK Town, LLL City	Red	Green	Drainage pump	
		F	MMM Town, NNN City	Pink	Yellow	Drainage pump	
	Type of inundation ③	A	OOO Town, PPP City	Red	Green	Levee reinforcement	
						Drainage pump	
Left bank	Type of inundation ④	A	QQQ Town, RRR City	Green	Green		
		B	SSS Town, TTT City	Yellow	Yellow	Flood control reservoir	
	Type of inundation⑤	A	UUU Town, VVV City	Yellow	Blue	Levee reinforcement	
		B	WWW Town, XXX City	Pink	Yellow	Drainage pump	
	Type of inundation⑥	A	YYY Town, ZZZ City	Yellow	Blue	Levee reinforcement	
		B	AAA Town, BBB City	Pink	Yellow	Drainage pump	

Watershed goal

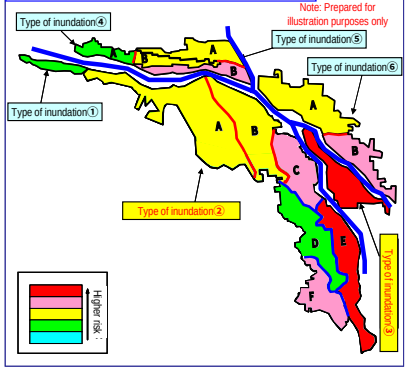
①Improvement measures are taken in order to lower the risk level of each block 30 years later by at least one level.

②(If the goal mentioned in ① is not achieved) Nonstructural measures are upgraded so that the safety level of higher-flood-risk blocks can be raised.

○ : area that satisfies certain conditions in connection with nonstructural measures for disaster resistance enhancement

Examples: the existence of a system for achieving evacuation in 30 minutes after receiving notice, the implementation of neighborhood associations' disaster prevention drills

Comparison between different types of inundation



Problems (tasks)

1. Finding ways to evaluate the level of safety
2. Identifying and developing evaluation items and methods needed to measure the degree of achievement of such goals as "zero victim" and "the prevention of paralysis of the central functions of the state"
3. Finding ways to evaluate various risks comprehensively

Establishment of flood forecast centers (provisional name)

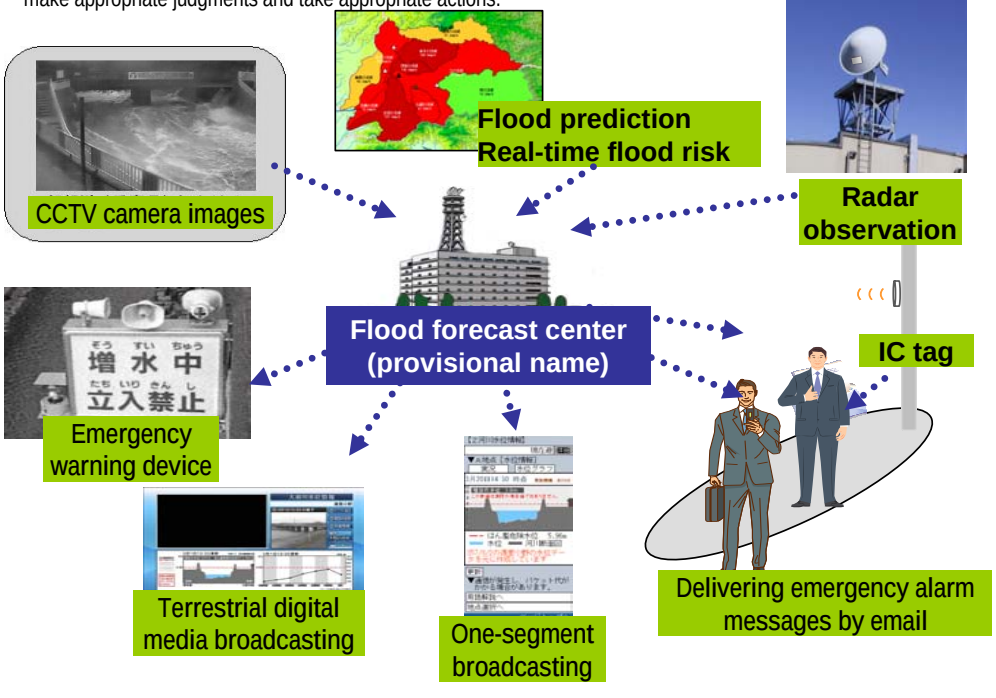
Ministry of Land, Infrastructure, Transport and Tourism

◇**In order to achieve the "zero victim" goal in the face of increasingly intense floods and localized heavy rains caused by climate change, flood forecast centers (provisional name) will be established in regional development bureaus to strengthen risk management measures in, for example, monitoring floods and providing information to municipal governments, the mass media, etc.**

◇**Flood forecast centers are to perform such tasks as climate change monitoring, flood risk evaluation and the development of an advanced flood prediction system.**

Strengthening flood-monitoring and information-providing capability

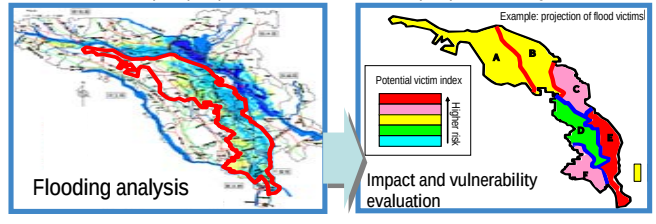
・High-accuracy weather radar systems and flood prediction systems are used for flood monitoring and information is provided by use of a variety of means of communication in order to better help municipal governments and the public make appropriate judgments and take appropriate actions.



Climate change monitoring and flood risk evaluation

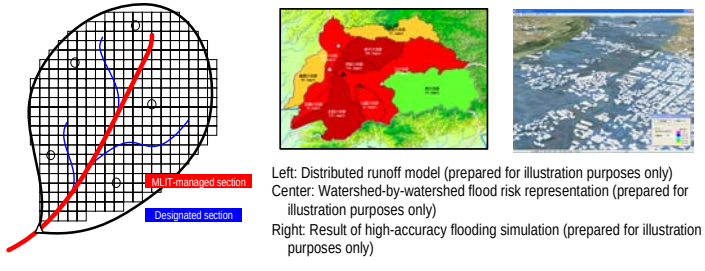
・The effects of increases and intensification of floods caused by climate change on people's daily life and the socio-economic conditions are identified through climate change monitoring and flood risk evaluation.

Example prepared for illustration purposes only



Development of an advanced flood prediction system

・With the aim of proper risk management consistent throughout the watershed, a flood prediction system for estimating flood distribution patterns, flood risk including landside flooding risk, real-time flooding patterns, etc., will be developed.



Left: Distributed runoff model (prepared for illustration purposes only)
Center: Watershed-by-watershed flood risk representation (prepared for illustration purposes only)
Right: Result of high-accuracy flooding simulation (prepared for illustration purposes only)