Small- to Mid-Size River Development Projects

Kanda River

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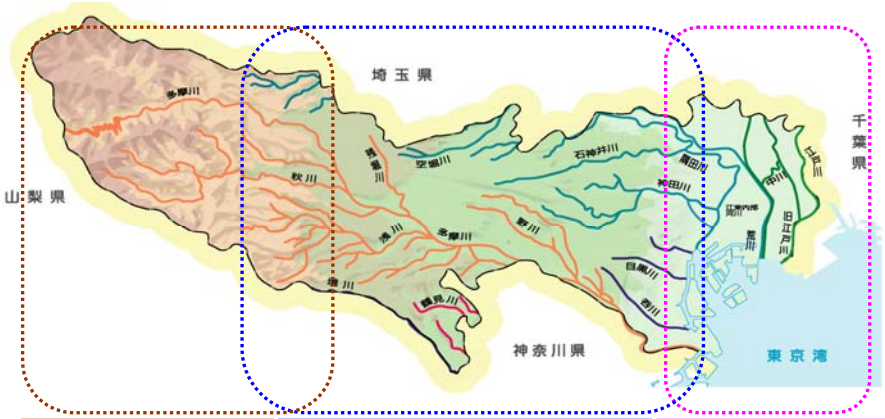
- Small- to Mid-Size River Development Projects
- Recent issues

1.1 The rivers of Tokyo

■Four river systems run through the Tokyo Metropolitan Area (the Tone, Ara, Tama, and Tsurumi Rivers)
■Class A Rivers (Minister-administrated): 92 rivers; Class B Rivers (Governor-administrated): 15 rivers



3. Sediment disaster prevention

1. Flood measures for small- and medium-size rivers

2. Storm surge and earthquake measures for lowland rivers

4. Preservation and maintenance of river environment

1.2 Prior damage: Large-scale flood damage caused by Kanogawa Typhoon (starting point of TMG flood-control measures)

■Sept. 1958 Typhoon No. 22 (Kanogawa Typhoon)

Conditions Min. pressure: 878hPa (post-WWII low), storm radius 400-500km, max wind speed 70m/s
Evening of the 26th: **76mm/hr** recorded (total rainfall 444.1㎜)

Damage Small- and medium-size rivers in the Santama region and 23 Special Wards overflowed, causing great damage, and heavy rainfall caused additional damage in lowland areas, **leaving 203 dead, 480,000 houses flooded, and a flood area of 211km2.**

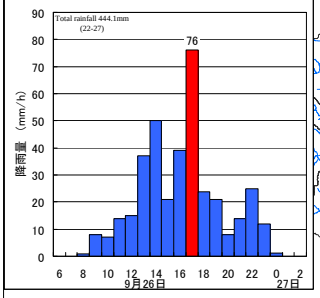
Kamata, Ota City: State of flooding near Nomi River's Shobu Bridge

Taishido, City of Setagaya: Condition of collapsed revetments near Karasuyama River's Taishi Bridge

State of flooding at Shakujii River

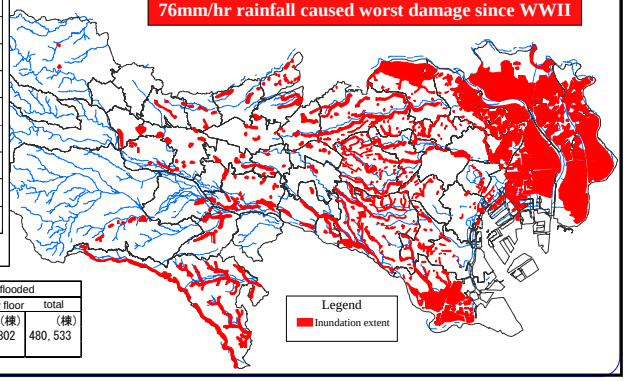
State of flooding at Naka River

Rainfall condition of 9:00, 26, Sept.- 0:00, 27, Sept. 1958



Map of inundation conditions and extent

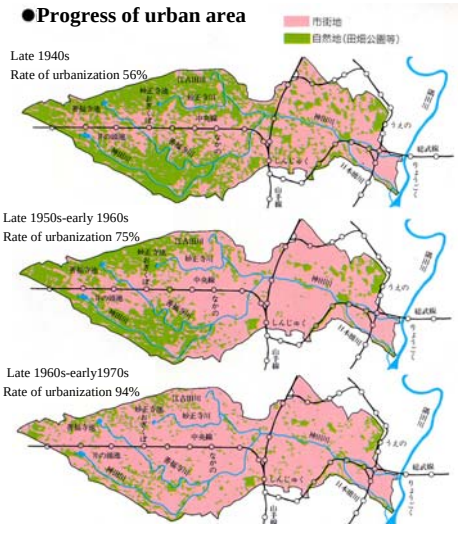
76mm/hr rainfall caused worst damage since WWII

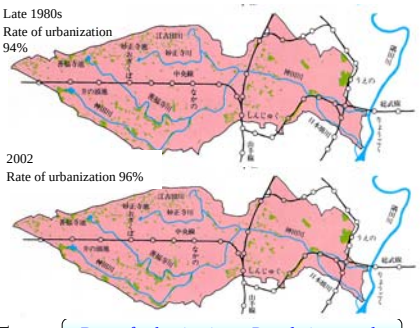


Disaster	Date	Area flooded	Houses flooded		
			above floor	below floor	total
Kanogawa Typhoon	1958.9.27	(ha) 21, 103	(棟) 337, 731	(棟) 142, 802	(棟) 480, 533

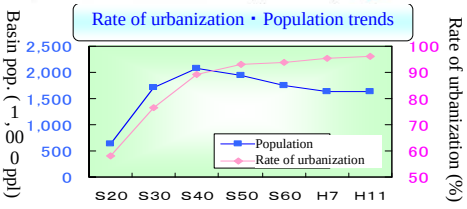
1.3 The progress of urbanization

●Progress of urban area





Rate of urbanization・Population trends

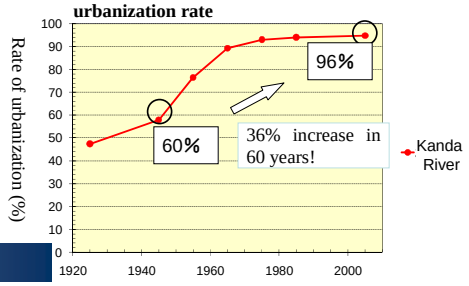


1.4 An urban runoff model

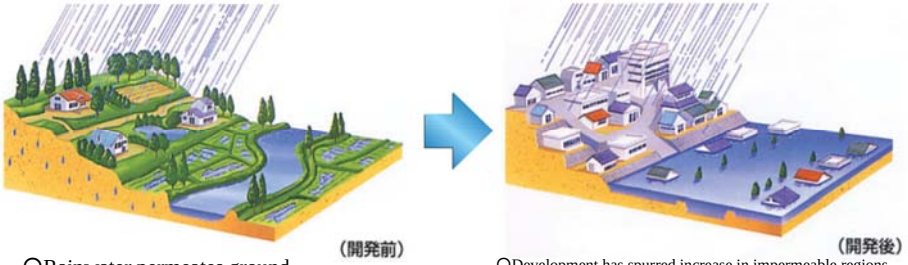
○ Tokyo has experienced drastic urbanization

○ Increase in runoff accompanying urbanization

(Ex.) Evolution of the Kanda River basin's urbanization rate



Increased runoff due to urbanization



○Rainwater permeates ground
○Surface water stopped from running into river

○Development has spurred increase in impermeable regions
○A high volume of surface water runs into river during short time

1.5 Major incidents of flood damage in recent years

Aug. 1989 Wada, Suginami City
(Kanda River)

Torrential rainfall
Total rainfall 276mm (Nakano)
Max hourly rainfall 70mm (Nakano)
Flood area 52ha
Number of flooded homes 2,669
(Kanda River)

Aug. 1993 Yayoi, Nakano City
(Kanda River)

Typhoon No. 11
Total rainfall 288mm (Yayoi)
Max hourly rainfall 47mm (Yayoi)
Flood area 85ha
Number of flooded homes 3,117
(in the most severe area)

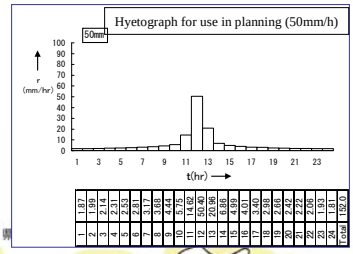
Sept. 2005 Kamitakada, Nakano City
(Myoshoji River)

Torrential rainfall
Total rainfall 263mm (Shimoigusa)
Max hourly rainfall 112mm (Shimoigusa)
Flood area Approx. 70ha
Number of flooded homes 3,103
(Shinjuku Ciyu, Nakano City, Suginami City)
(Figures based on flash report)

1.6 Flood control measures of small- and medium-size rivers ～Development standard and overall plan～

(1) Development standard: Handle 50mm/hr rainfall
(2) Overall plan: Develop 324km of revetments along 46 rivers

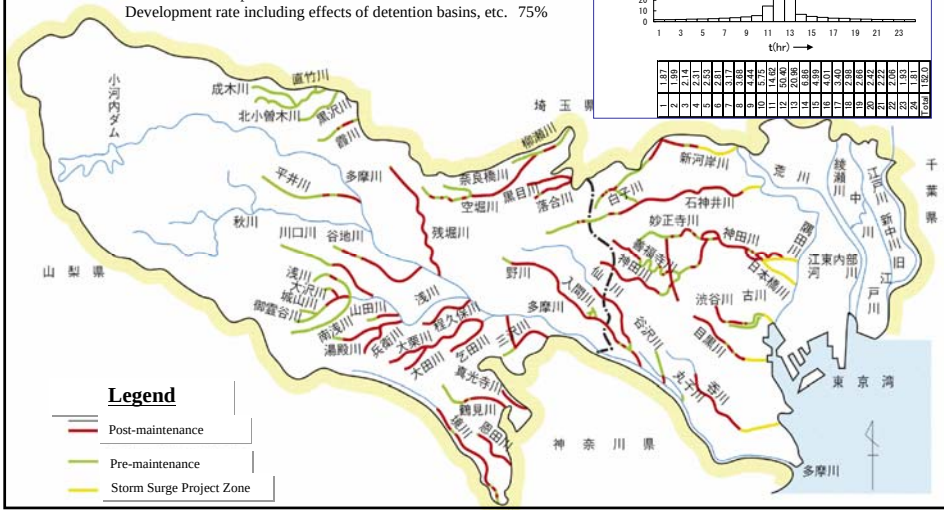
① Hyetograph for use in planning (50mm/h)



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1.67	1.98	2.14	2.31	2.53	2.81	3.17	3.69	4.44	5.75	14.62	25.00	50.00	20.00	8.89	6.06	4.69	4.00	3.48	3.08	2.78	2.42	2.22	1.93	1.81	1.52.0

② (As of April, 2011)

Length of post-maintenance revetments	204.2km
Revetment development rate	63%
Development rate including effects of detention basins, etc.	75%

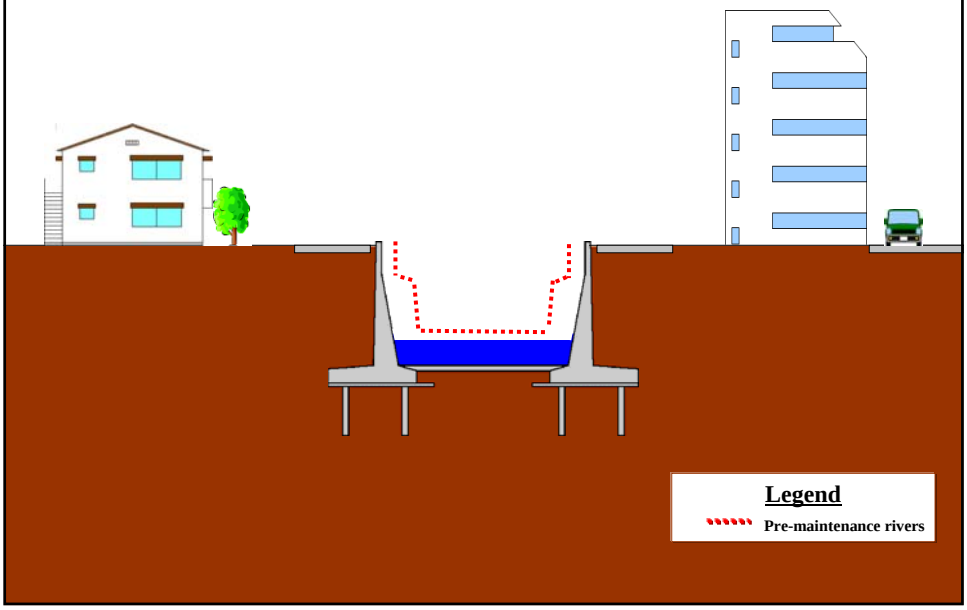


Legend
- Post-maintenance
- Pre-maintenance
- Storm Surge Project Zone

1.7 Small- to Mid-Size River Development Projects

- **Fundamental plan to conduct river improvements (revetment development) in order from lower reaches**
  - **Purchase land along river and widen river width**
  - **Lower riverbed**
- **In areas where land acquisition requires extended time or revetment development proves difficult**
  - **Develop detention basins and diversion channels and increase safety level**

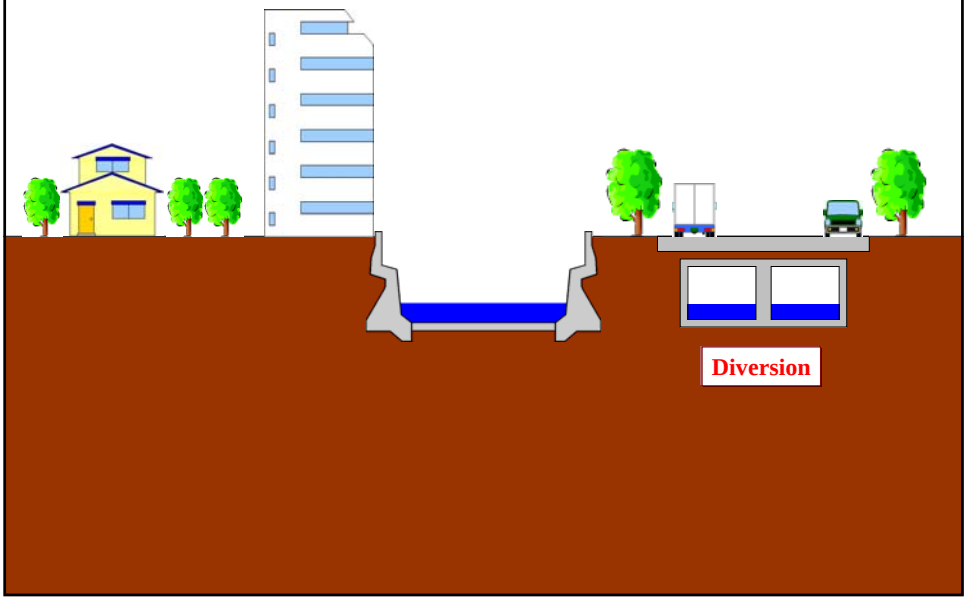
1.8 River repairs (revetment development)



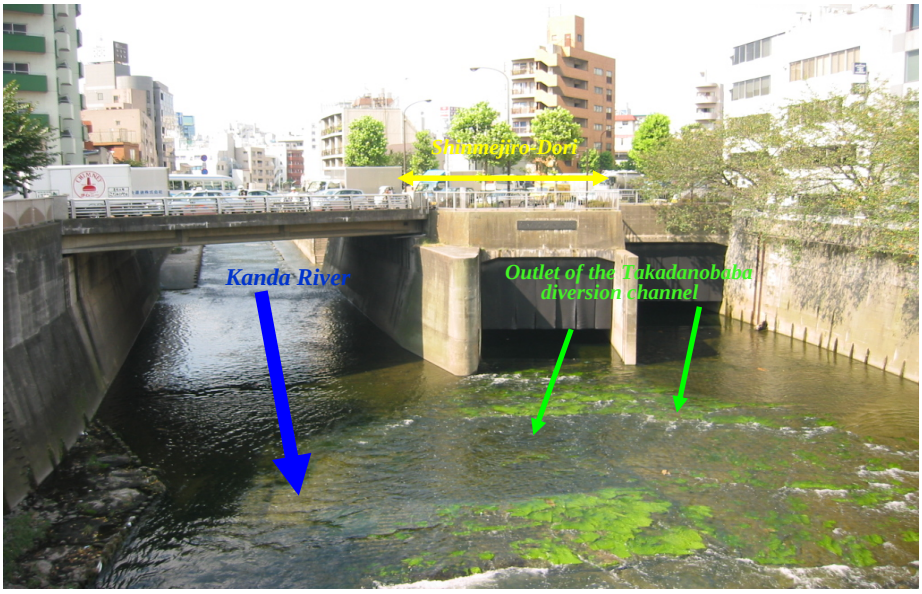
1.9 State of repairs on the Kanda River

Before ⇒ After

1.10 Diversion channel

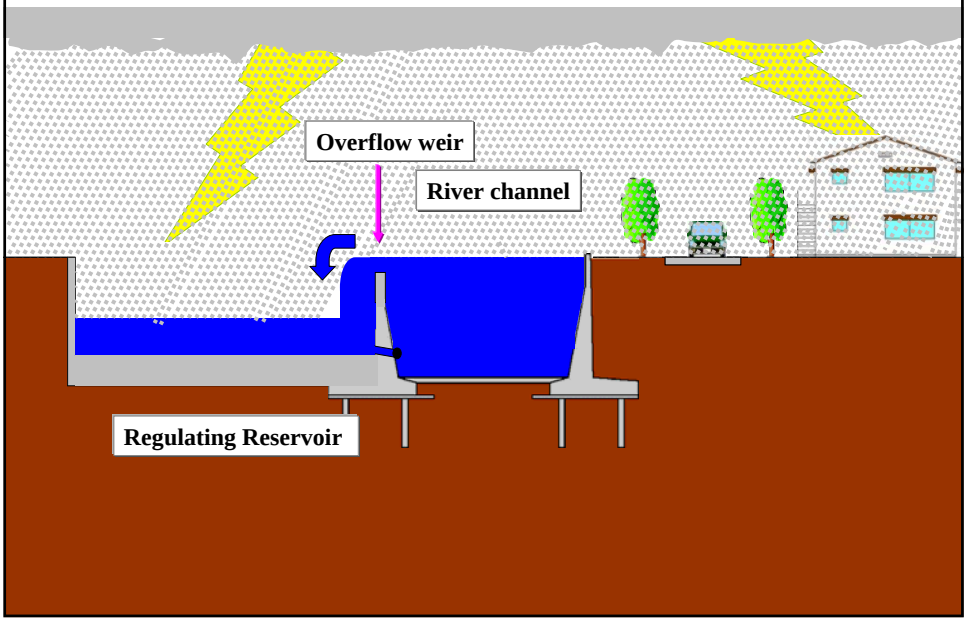


1.11 State of diversion channel development



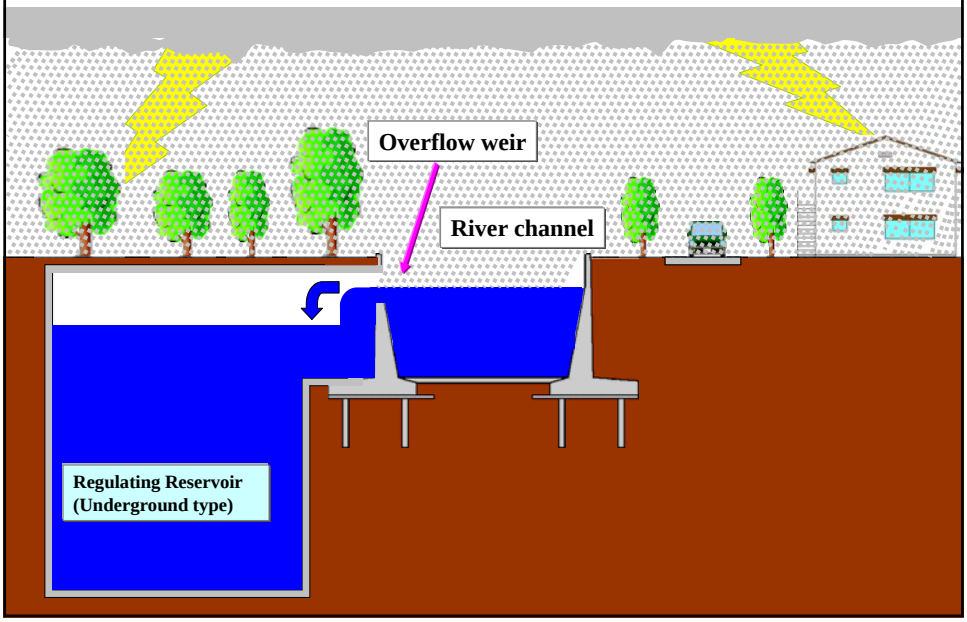
1.12 Regulating Reservoir (Sunken type)

Regulating Reservoir (Sunken type)



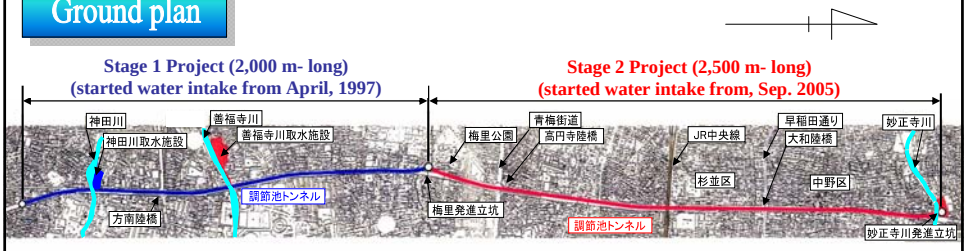
1.13 Regulating Reservoir (Underground type)

Regulating Reservoir (Underground type)

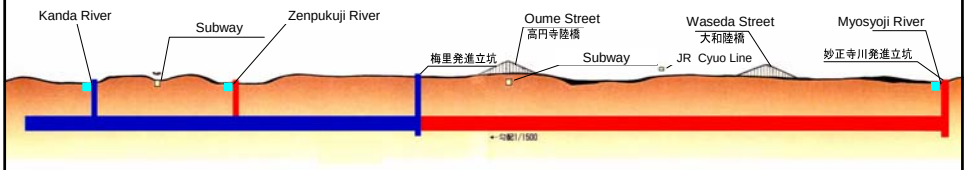


1.14 Kanda River/ Loop Road No.7 Underground Regulating Reservoir

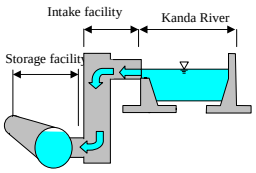
Ground plan



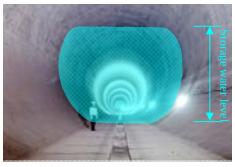
Cross-section view



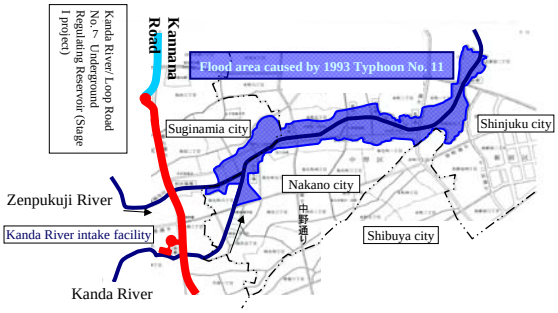
1.15 Effects of the Kanda River/ Loop Road No.7 Underground Regulating Reservoir



Inflow conditions at the Kanda River intake facility



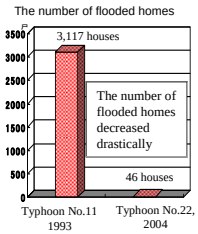
Inflow reached 90% of storage capacity (240,000m3)



Comparison of 1993 Typhoon No. 11 and 2004 Typhoon No. 22

	Typhoon No.11 (27, August, 1993)	Typhoon No.22 (October 9, 2004)
Total Rainfall (per hour)	288mm (47mm)	284mm (57mm)
Area Flooded	85 ha	under 3 ha
Houses flooded (above and below floor)	3,117 houses	46houses

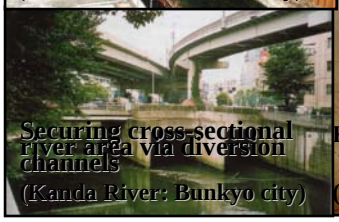
※Rainfall record is of the Yayoicho Observation Station



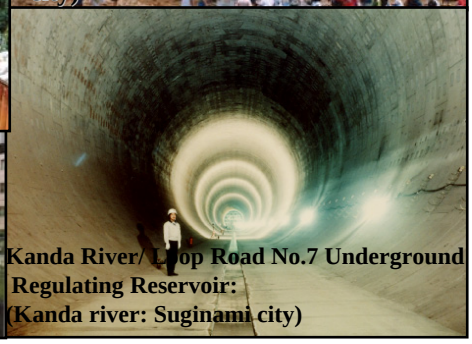
1.16 Flood control measures of small- and medium-size rivers ～Practical examples～

River widening through revetment development
(Kanda River: Nakano city)

Tama River development
(Karabori River: Higashimurayama city)



Securing cross-sectional river area via diversion channels
(Kanda River: Bunkyo city)



Kanda River/ Loop Road No.7 Underground Regulating Reservoir:
(Kanda river: Suginami city)

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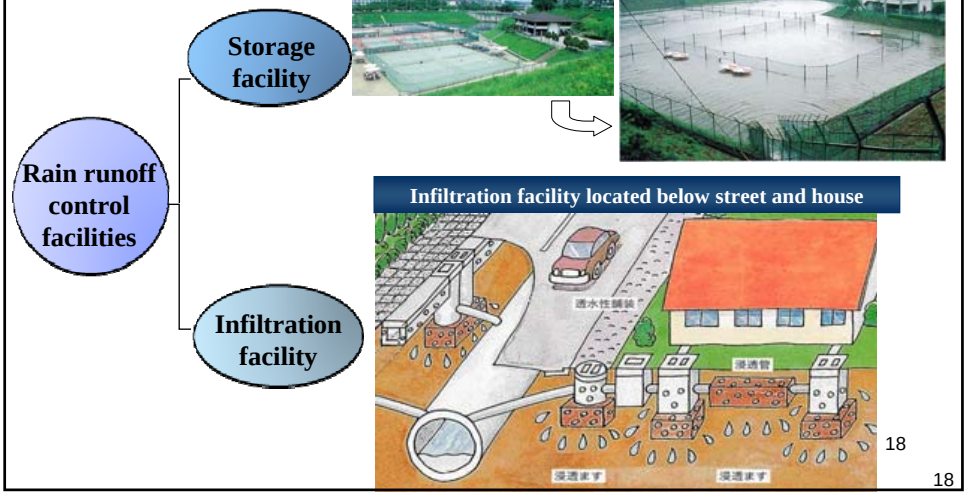
1.16 River basin measures

Establish storage and infiltration facilities in limited urban areas



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Recent issues

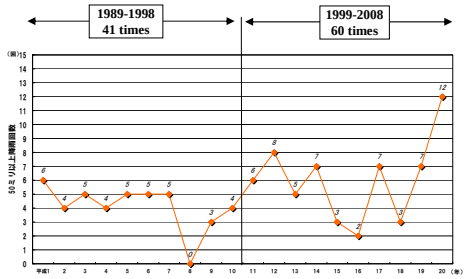
- **The state of future river development**
- **Emergency measures for torrential rains (concerning river development)**

2.1 Recent trends in intense rainfalls in Tokyo

Downpours showing an increase

Regarding the frequency of rainfall exceeding 50mm/hr from 1989 to late September 2008, the latter half of this period (1999-2008) has shown definite signs of an increase over the former half (1989-1998).

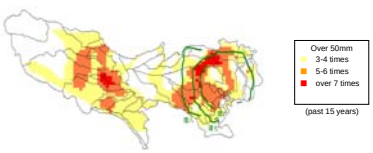
Number of rainfalls with over 50mm/hr from 1989 to late September 2008



Downpours concentrated in one region

Rains exceeding 50mm/hr have a tendency to concentrate in the region from Kanroku-Dori to Kanpachi-Dori, or the western section of the 23 Special Wards and the Tama region.
Viewed by region, there are areas along the Shakujii, Kanda, Shibuya, and No Rivers with high downpour frequencies
Areas frequently receiving over 75mm/hr downpours are concentrated in the upper reaches of the Kanda River and Shakujii River, or the northwest area of the 23 Special Wards, including Nakano City and Nerima City

Rainfall over 50mm



Rainfall over 75mm

Source: "Record of flood damage" Bureau of Constructions, TMG

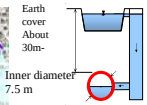
Occurrence distribution of rainfall over 50mm, 75mm per hour (1991- 2005)

2.2 The state of future river development

Speed up the "50mm-countermeasure"

Maintenance of the Furukawa Underground Detention Basin（H20～27）

Surrounded by the Metropolitan Expressway Company and buildings



Tunnel length: about 3.3km
Storage volume: about 135,000m3

Resume development of the Shirako River Underground Detention Basin（H21～29）

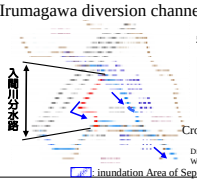
The current condition of the starting shaft At the Kan-Etsu Expressway D Ramp

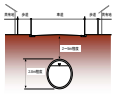
Work done on starting shaft from 1991-1998, but discontinued

Image of Underground Reservoir

Development of the Irumagawa diversion channel（H21～24）

Houses stand alongside the river (downstream of the Shinmei Bridge)





Cross section of upstream

Diversion channel length: 約1，２ｋｍ
Water flow: １０㎥/s

: inundation Area of Sep.4, 2005

Consideration of river development

Consider the state of river improvements based upon the Basic Policy for Intense Rainfalls and with consideration given to handling 75mm rainfalls, such as during the Kanogawa Typhoon

Handle a rain of 75mm

Kanogawa Typhoon brought unprecedented damage to Tokyo
Sep, 1958
Area flooded: 211km²
House flooded: over 460,000
Dead and injured: 203 people
Total rainfall: 444 mm
Max. per hour: 76 mm

⇒ ***Raise the flood-safety level from being able to handle a 50mm rainfall (1 in 3 years) ↓ to a rainfall of 75mm (1 in 15 years)***

○ Commission investigation (FY2009-2010)
For example, analysis of previous rainfall data, assessment of existing river facilities, general consideration of new river facilities, the effects of development

○ Predicated on the investigation results and advice of those with experience, formulate early on an outline of the nature of river development

3.1 Formulate new emergency measures for torrential rains ～Protect Tokyo from local downpours～

Previous initiatives

River
- Expand rivers and develop revetments
- Develop diversion channels and detention basins

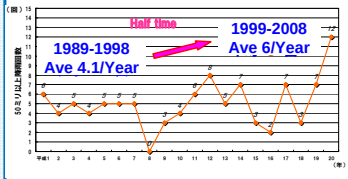
Sewage
- Develop key facilities, including sewage trunk lines and pump sites
- Implement the Rainwater Maintenance Quick Plan

Local development
- Promote rainwater infiltration facilities for plots of over 500m2
- Aid in the construction of infiltration facilities for private housing (ward and city)

Current issues

○ Local heavy rains exceeding 50mm/hr appear frequently in certain areas

○ Heavy rains exceeding 100mm/hr also occur



Frequency of heavy rains exceeding 50mm/hr (within Tokyo)

○ Flooding risk increases with intensive use of subway and underground cities

○ While river- and sewage-development are showing progress, time still remains until completion

Fundamental approach

○ Give concentrated treatment to areas highest threatened by flood damage
○ Flood damage can be promptly mitigated through emergency measures
○ Close cooperation between prefecture, ward and city, and citizens

Emergency measures

Intake water into underground detention basin from other watersheds

- Consider water intake into the Shirako River Underground Detention Basin from the Shakujii River
- Shorten the schedule for the Shirako River Underground Detention Basin currently under construction by 1 year

Expand measures for large-scale underground cities, etc.

- Include five additional districts, including Ginza, in underground city measures and accelerate development of sewage facilities (storage pipes)
- Accelerated development of the sewage facilities (storage pipes, etc.) for the Kanda, Shakujii, and Shirako River basins
- Assist the formulation of an evacuation plan in 9 areas, including Kabuki-cho's underground city

Promote temporary storage facilities utilizing public facilities

- Consider effective storage use of public facilities (schools, parks, municipal housing), and promote establishment of temporary storage facilities

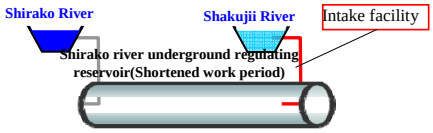
Provide disaster information to protect lives and lifeways

- In addition to an information system, establish surveillance system (cameras, etc.) and implement advance provisioning of new emergency information for Shakujii River sent immediately to citizens, with the basin area's cooperation

Formulate new intense rainfall emergency measures
Implement viable measures from FY2011

3.2 Policy for intense rainfall emergency measures

Water intake into underground basin from other watersheds



Water intake visualization

Promote temporary storage facilities utilizing public facilities

Schoolyard storage example (underground type)

Expand measures for large-scale underground cities, etc.

Sewage facility example (storage pipe)

Provide disaster information to protect lives and lifeways

Response situation of the flood prevention headquarters